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CRETACEOUS FLORAS OF THE NORTHWEST TERRITORIES OF CANADA.

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GEOLOGICAL RELATIONS OF THE FLORAS.

IN my memoir in the First volume of the Transactions of this Society, I have given a table of the formations prepared by Dr. G. M. Dawson, and have fully stated the geological position of the plants at that time described. The new facts above detailed now require us to intercalate in our table three distinct plant horizons not previously recognized in the western territories of Canada. One of these, the Kootanie series, should probably be placed at the base of the table as a representative of the Urgonian or Neocomian, or, at the very least, should be held as not newer than the Shasta group of the United States Geologists, and the Lower Sandstones and Shales of the Queen Charlotte Islands. It would seem to correspond in the character of its fossil plants with the oldest Cretaceous floras recognized in Europe and Asia, and with that of the Komé formation in Greenland, as described by Heer. No similar flora seems yet to have been distinctly recognized in the United States, except, perhaps, that of the beds in Maryland, holding cycads, and which were referred many years ago by Tyson to the Wealden.

[1] This paper states the general conclusions of a memoir, by Sir William Dawson, in the Transactions of the Royal Society of Canada, which will appear with descriptions and illustrations of the new species in the course of next winter.

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The second of these plant horizons, separated according to Dr. G. M. Dawson, by a considerable thickness of strata, is that which he has called the Mill Creek series, and which corresponds very closely with that of the Dakota group, as described by Lesquereux, and that of the Atané and Patoot formations in Greenland, as described by Heer. This fills a gap indicated only conjecturally in the section of 1883. Along with the plants from the Dunvegan group of Peace River, described in 1883, it would seem to represent the flora of the Cenomanian and Senonian divisions of the Cretaceous in Europe.

Above this we have also to intercalate a third sub-flora, that of the Belly River series at the base of the Fort Pierre group. This, though separated from the Laramie proper by the marine beds of the Pierre and Fox Hill groups, more than 1,700 feet in thickness, introduced the Laramie or Danian flora, which continues to the top of the Cretaceous, and probably into the Eocene, and includes several species still surviving on the American continent, or represented by forms so close that they may be varietal merely.

Lastly: the subdivision of the Laramie group, in the last report of Dr. G. M. Dawson, into the three members known respectively as the Lower or St. Mary River series, the Middle or Willow Creek series, and the Upper or Porcupine Hill series, in connection with the fact that the fossil plants occur chiefly in the lower and upper members, enables us now to divide the Laramie flora proper into two sub-floras, an older, closely allied to the underlying Belly River series; and a newer, identical with that of Souris River, described as Laramie in Dr. G. M. Dawson's Report on the 48th Parallel, 1876, and in the Report of the Geological Survey of Canada for 1879, and which appears to agree with that known in the United States as the Fort Union group, and with the so-called Miocene of Heer from Greenland.

From the animal fossils and the character of the flora, it would seem probable that the rich flora of the Cretaceous coal fields of Vancouver Island is nearly synchronous with that of the coal-bearing Belly River series of the western plains.

It will thus be seen that the explorations already made in Canadian territory have revealed a very complete series of Cretaceous plants, admitting, no doubt, of large additions to the number of species by future discoveries, and also of the establishment of con-

necting links between the different members, but giving a satisfactory basis for the knowledge of the succession of plants and for the determination of the ages of formations by their vegetable fossils.

The successive series may be tabulated as follows, with references for details to the fuller table in my memoir of 1883:—

SUCCESSIVE FLORAS AND SUB-FLORAS OF THE CRETACEOUS IN CANADA.

(IN DESCENDING ORDER.)

PERIODS.	FLORAS AND SUB-FLORAS.	REFERENCES.
Danian	Upper Laramie and Porcupine Hill Series	Platanus beds of Souris River and Calgary. Report Geol. Survey of Canada for 1879, and present memoir.
	Middle Laramie or Willow Creek Series.	
	Lower Laramie or St. Mary River Series	Lemna and Pistia beds of bad lands of 49th Parallel, Red Deer River, etc., with Lignites. Report 49th Parallel and this memoir.
Senonian	Fox Hill Series	Marine.
	Fort Pierre Series	Marine.
	Belly River Series. (See note)	Sequoia and Brasenia beds of S. Saskatchewan, Belly River, etc., with Lignites. This memoir.
	Coal Measures of Nanaimo, B.C., probably here.	Memoir of 1883. Many Dicotyledons, Palms, etc.
Cenomanian	Dunvegan Series of Peace River. (See note)	Memoir of 1883. Many Dicotyledons, Cycads, etc.
	Mill Creek Series of Rocky Mountains	Dicotyledonous leaves, similar to Dakota Group of the U. S. This memoir.
Neocomian & Urgonian	Suskwa River and Queen Charlotte Island Series. Intermediate Series of Rocky Mountains	Cycads, Pines, a few Dicotyledons. Report Geol. Survey. This memoir.
	Kootanie Series of Rocky Mountains	Cycads, Pines and Ferns. This memoir.

NOTE.—Though the flora of the Belly River Series very closely resembles that of the Lower Laramie, showing that similar plants existed throughout the Senonian and Danian periods in North America, yet it is to be anticipated that specific differences will develop themselves in the progress of discovery. In the meantime it scarcely seems possible to distinguish by fossil plants alone the Lower Laramie beds from those of Belly River, and if these are really separated by 1,700 feet of marine strata, as is now believed on stratigraphical grounds, the flora must have been remarkably persistent. The Dunvegan series of Peace River probably corresponds in time with the Marine Niobrara Group farther South.

In connection with the above table it should be understood that Tertiary floras, probably Miocene in age, are known in the interior of British Columbia, though they have not yet been recognized in the territories east of the Rocky Mountains.

Before leaving this part of the subject I would deprecate the remark which I see occasionally made, that fossil plants are of little value in determining geological horizons in the Cretaceous and Tertiary. I admit in these periods some allowance must be made for local differences of station, and also that there is a generic sameness in the flora of the Northern Hemisphere, from the Cenomanian to the modern, yet these local differences and general similarity are not of a nature to invalidate inferences as to age. No doubt palæobotanists seem obliged, in deference to authority, and to the results of investigations limited to a few European localities, to group together, without distinction, all the floras of the later Cretaceous and earlier Tertiary, irrespective of stratigraphical considerations, the subject lost its geological importance. But when a good series has been obtained in any one region of some extent, the case becomes different. Though there is still much imperfection in our knowledge of the Cretaceous and Tertiary floras of Canada, I think the work already done in Canada in connection with that of Lesquereux and Newberry in the United States, is sufficient to enable any competent observer to distinguish by their fossil plants the Lower, Middle and Upper Cretaceous, and the latter from the Tertiary.

PHYSICAL CONDITIONS AND CLIMATE INDICATED BY THE CRETACEOUS FLORAS.

In the Jurassic and earliest Cretaceous periods the prevalence, over the whole of the Northern Hemisphere and for a long time, of a monotonous assemblage of gymnospermous and Acrogenous plants, implies a uniform and mild climate and facility for intercommunication in the north. Toward the end of the Jurassic and the beginning of the Cretaceous, the land of the Northern Hemisphere was assuming greater dimensions, and the climate probably becoming a little less uniform. During the close of this period or at the beginning of the next, the dicotyledonous flora seems to have been introduced, under geographical conditions which permitted a warm temperate climate to extend as far north as Greenland.

In the Cenomanian, we find the Northern Hemisphere tenanted with dicotyledonous trees closely allied to those of modern times, though still indicating a climate much warmer than that which at present prevails. In this age, extensive but gradual submergence of land is indicated by the prevalence of chalk and marine limestones over the surface of both continents; but a circumpolar belt of land seems to have been maintained, protecting the Atlantic and Pacific basins from floating ice, and permitting a temperate flora of great richness to prevail far to the north, and especially along the southern margins and extensions of the circumpolar land. These seem to have been the physical conditions which terminated the existence of the old Mesozoic Flora and introduced that of the Middle Cretaceous.

As time advanced, the quantity of land gradually increased, and the extension of new plains along the older ridges of land was coincident with the deposition of the great Laramie series, and with the origination of its peculiar flora, which indicates a mild climate and considerable variety of station in mountain, plain and swamp, as well as in great sheets of shallow and weedy fresh water.

In the Eocene and Miocene periods the continent gradually assumed its present form, and the vegetation became still more modern in aspect. In that period of the Eocene, however, in which the great nummulitic limestones were deposited, a submergence of land occurred on the Eastern continent which must have assimilated the physical conditions to those of the Cenomanian. This great change, affecting materially the flora of Europe, was not proportionately great in America, which also by the north and south extension of its mountain chains permitted movements of migration not possible in the Old World. From the Eocene downwards, the remains of land animals and plants are found only in lake basins occupying the existing depressions of the land, though more extensive than those now existing. It must also be borne in mind, that the great foldings and fractures of the crust of the earth which occurred at the close of the Eocene, and to which the final elevation of such ranges as the Alps and the Rocky Mountains belongs, permanently modified and moulded the forms of the continents.

These statements raise, however, questions as to the precise

equivalence in time of similar floras found in different latitudes. However equable the climate, there must have been some appreciable difference in proceeding from north to south. If, therefore, as seems in every way probable, the new species of plants originated on the Arctic land and spread themselves southward, this latter process would occur most naturally in times of gradual refrigeration or of the access of a more extreme climate, than is in times of the elevation of land in the temperate latitudes, or conversely, of local depression of land in the Arctic, leading to invasions of northern ice. Hence the times of the prevalence of particular types of plants in the far north would precede those of their extension to the south, and a flora found fossil in Greenland might be supposed to be somewhat older than a similar flora when found farther south. It would seem, however, that the time required for the extension of a new flora to its extreme geographical limit, is so small in comparison with the duration of an entire geological period that practically, this difference is of little moment, or at least does not amount to antedating the Arctic flora of a particular type by a whole period, but only by a fraction of such period.

It does not appear that during the whole of the Cretaceous and Eocene periods there is any evidence of such refrigeration as seriously to interfere with the flora, but perhaps the times of most considerable warmth are those of the Dunvegan group in the Middle Cretaceous and those of the later Laramie and Palæocene.

It would appear, that no cause for the mild temperature of the Cretaceous needs to be invoked, other than those mutations of land and water which the geological deposits themselves indicate. A condition for example of the Atlantic basin in which the high land of Greenland should be reduced in elevation and at the same time the northern inlets of the Atlantic closed against the invasion of Arctic ice, would at once restore climatic conditions allowing of the growth of a temperate flora in Greenland. Dr. Brown has shown,[1] and, as I have elsewhere argued, the absence of light in the Arctic winter is no disadvantage, since, during the winter, the growth of deciduous trees is in any case suspended, while the constant continuance of light in the summer is, on the contrary, a very great stimulus and advantage.

[1] Florula Discana.

It is a remarkable phenomenon in the history of the genera of plants in the later Mesozoic and Tertiary, that the older genera appear at once in a great number of specific types, which become reduced as well as limited in range down to the modern. This is, no doubt, connected with the greater differentiation of local conditions in the modern; but it indicates also a law of rapid multiplication of species in the early life of the genera. The distribution of the species of *Salisburia, Sequoia, Platanus, Sassafras, Liriodendron, Magnolia*, and many other genera, affords remarkable proofs of this.

Gray, Saporta, Heer, Newberry, Lesquereux' and Starkie Gardner, have all ably discussed these points; but the continual increase of our knowledge of the several floras, and the removal of error as to the dates of their appearance, must greatly conduce to clearer and more definite ideas. In particular, the prevailing opinion that the Miocene was a period of great extension of warmth and of a temperate flora into the Arctic, must be abandoned in favor of the later Cretaceous and Eocene; and if I mistake not, this will be found to accord better with the evidence of general geology and of animal fossils.

ON THE INFLUENCE OF CIRCUMSTANCES ON THE ACTIONS AND HABITS OF ANIMALS, AND THAT OF THE ACTIONS AND HABITS OF LIVING BODIES, AS CAUSES WHICH MODIFY THEIR ORGANIZATION.

BY J. B. P. A. LAMARCK.[1]

THE question here is not one of reasoning, but the examination of a positive fact, which is more general than is thought, and to which people have neglected to give the attention which it merits without doubt because, often, it is very difficult to recognize. This fact consists in the influence exercised by circumstances on the different living bodies, which find themselves subjected to them. In fact, the influence of different states of our organism on our character, our inclinations, our actions, and also our ideas, has been long remarked; but it seems to me no one yet has recognized what influence our actions and our habits have upon our organization itself. Now, as these actions and these habits depend entirely upon the circumstances in which we habitually find ourselves, I will attempt to point out how great is the influence which circumstances exercise on the general form, on the condition of parts, and thus upon the organization of living bodies. It is this very certain fact which is the question discussed in this chapter.

If we had not had numerous opportunities to recognize clearly the effect of these influences on certain living bodies which we have placed in altogether new circumstances, and very different from those to which they were accustomed, and if we had not seen the effects and changes which have resulted, exhibiting themselves in many ways, under our eyes, the important fact in question would always have remained unknown to us.

The influence of circumstances manifesting itself in bodies possessing life, is effectual in all time and everywhere; but that which renders this influence difficult for us to perceive, is that these effects

[1] Constituting the Chap. VII., Vol. I., of the Philosophie Zoölogique. Translated for the American Naturalist by Dr. Eleanor E. Galt, from the edition of 1809.

only become sensible or recognizable (especially among animals) after a long time.

Before showing and examining the proofs of these facts, which deserve our attention, and which are of great importance to Philosophical Zoology, let us again take up the thread of considerations which we have already had in hand.

In the preceding chapter we have seen that it is at present an incontestable fact that in considering the animal scale in an inverse sense to that of nature, we find that there exists in the bodies which compose this scale a continual but irregular degradation in the organization of the animals which compose it; a growing simplification of the organization of living bodies, and finally a proportional diminution in the number of faculties of these beings.

This well-known fact throws the greatest light upon the order which nature has followed in the production of all existing animals; but it does not point out to us why the organization of animals in its growing constitution, from the most imperfect up to the most perfect, shows only irregular gradation, of which the facies presents numerous anomalies or digressions, having no appearance of order in their diversity.

Now, in searching for the reason of this singular irregularity in the growing constitution of the organization of animals, if we consider the result of the influence which circumstances, infinitely diversified in all parts of the globe, exercise on the general form, the parts, and the organization itself of the animals, all then will be clearly explained.

It will be, in fact, evident that the state in which we see all animals, is, on one side, the product of the growing constitution of the organization which tends to form a regular gradation, and, on the other side, that it is the influence of a multitude of very different circumstances which are tending continually to destroy the regularity in the gradation of the growing constitution of the organization.

Here it becomes necessary to explain myself as to the meaning which I attach to these expressions: *The circumstances influence the form and organization of animals,* that is to say, that in becoming very different they change in time both their form and their organization itself, by proportional modifications. Surely, if these

expressions were taken literally, an error would be ascribed to me; for, whatever the circumstances might be, they would not produce directly any modification whatever in the form and organization of the animals.

But great changes in circumstances bring among animals great changes in their wants, and changes in their wants necessarily bring parallel modifications into their actions. Now, if the new wants become constant or very lasting, the animals will adopt new habits, which are as permanent as the wants which produced them. This is a fact easy of demonstration, such as requires no explanation to be appreciated.

It is then evident that a great change in circumstances becoming constant in a race of animals, entails upon these animals new habits.

Now, if new circumstances becoming permanent with a race of animals, have given to these animals new habits; that is to say, have forced them to new actions, which have become habitual, the consequence will be the employment of some part, in preference to some other part, and in certain cases the total lack of employment of a part which has become useless.

Nothing of all this should be considered as an hypothesis, or as a private opinion; they are, on the contrary, truths which, in order to be rendered evident, require only attention and observation of facts. We shall see directly by the citation of known facts, which prove, on one side, that new wants, having rendered a certain part necessary, have really by repeated efforts created this part, and in consequence of repeated employment have little by little strengthened and developed them, and have resulted in a considerable increase of size. On the other hand, we shall see that in certain cases new circumstances and new wants having rendered a certain part entirely useless, the total lack of employment of that part has caused its growth gradually to cease; that it becomes small and attenuated little by little, and that finally, when this lack of employment has been total for a long time, the part in question disappears.

All this is certain, and I now propose to give the most convincing proof. In vegetables, which have no movements, and in consequence no habits, properly speaking, great changes of circumstances

bring great differences in the development of their parts, so that these differences create and develop some of them, whilst they diminish and abolish others.

But here all goes on by changes wrought in nutrition of the vegetable, in its absorptions and its respirations, in the quantity of caloric, of light, of air and humidity, which it then habitually receives; finally in the superiority which certain of the diverse vital movements may exercise over the others.

Among individuals of the same species, some of which are continually well nourished, and under circumstances favorable to their development, while others are subjected to opposite conditions, there will be produced a difference of development which gradually becomes very well marked. How many examples could I not cite in regard to animals and vegetables which would confirm this assertion! Now, if circumstances remaining the same, render the state of badly nourished, suffering or languishing individuals habitual and constant, their interior organization is finally modified; and reproduction among these individuals in question preserves these acquired modifications, and at last gives origin to a race very distinct from that whose individuals are found continually in circumstances favorable to their development. A very dry spring is the reason why the grasses of a meadow grow very little and are meagre and mean, although they blossom and fruit. A spring time of warm and rainy days causes the same grasses to take on much growth, and the harvest of hay is then excellent. But if any cause perpetuates unfavorable circumstances for these plants, they will vary proportionally, at first in their appearance or general condition, and finally in various particulars of their characters. For example, if some seed of any one of these grasses of the meadow in question, be transferred to an elevated locality, dry, arid, stony, and much exposed to winds, and there germinate, the plant which will live in this locality, though always badly nourished, and the individuals which it reproduces then continuing to exist under these adverse circumstances, there will result a species very different from the species living in the meadow, from which it has originated. The individuals of this new race would be small, slender in their parts, and certain of their organs having developed more than others, would then present peculiar proportions.

Those who have observed much, and who have consulted great collections, have been able to convince themselves that, according as the circumstances of habitat, of exposure, climate, nourishment and habit of life, etc., change; the characters of size, form, proportion of parts, color, consistence, activity and labors, of animals change in proportion. That which nature does slowly we can do every day, by changing suddenly, in the case of a living vegetable, the circumstances by which it and all the individuals of its kind are surrounded. All botanists know that vegetables which are taken from their native place into gardens to be cultivated, gradually undergo changes which render them finally unrecognizable. Many plants naturally very hairy become smooth, or nearly so; numbers of those which were creeping and trailing, straighten their stems; others lose their spines or their roughness; still others possessing woody and long-lived (perennial) stems in warm climates which they inhabited, pass, in our country, into an herbaceous state (many are only annual plants); finally the dimensions of their parts undergo very considerable changes. These effects of changes of circumstances are so well known that botanists do not like to describe garden plants unless they have been recently cultivated. Is not cultivated wheat (*Triticum sativum*) a vegetable, brought by man to the state in which we actually see it? Who can tell me in what country a like plant has its habitat without being there the result of culture? Where do we find in nature our cabbages, our lettuces, etc., in the state in which we possess them in our kitchen gardens? Is it not the same in regard to many animals which domestication has changed or considerably modified? How many different races among our poultry and domestic pigeons have we procured by raising them under diverse circumstances and in different countries, and how vain would be our search to find such in nature! Those which are the least changed, without doubt by less ancient domestication, and because they do not live in a climate strange to them, present no less, in the condition of certain of their parts, great differences, produced by habits which we have caused them to contract. Thus our domestic ducks and geese find their type in wild ducks and geese; but ours have lost the power to rise high in the air, and to traverse great distances by flying; there has been, in fact, a real change in the state of their parts, com-

pared with those animals of the race from which they came. Who does not know that any bird of our climate which we have raised in a cage, and which has lived there five or six years, continuously, when liberated is not able to fly as its kind who have always been free? This trifling change of circumstance acting on this individual, has in truth only diminished its faculty of flight, and without doubt has made no change in the form of the parts of the individuals. But if successive generations of individuals of the same race had been held in captivity during a considerable time, there is no doubt that even the form of the parts would little by little have undergone notable changes. A stronger reason yet, if instead of a simple captivity maintained in regard to them, this circumstance has been for some time accompanied by a change of very different climate, and that these individuals by degrees had been habituated to other kinds of food, and to other movements to get it, certainly these circumstances united and become constant would have formed insensibly a new race altogether peculiar. Where is found now in nature the multitude of races of dogs which, in consequence of the domestication to which we have reduced them, have been brought into the condition in which they are at present? Where are found the bulldogs, greyhounds, spaniels and lapdogs, etc., races which show in themselves greater differences than those which we would admit as specific among animals of the same genus living at liberty in nature?

Without doubt a first and unique race, first cousin of the wolf, if not himself the true type, has been some time tamed and domesticated by man. This race, which showed at that time no difference among the individuals, has been gradually dispersed with man into different countries and into different climates, and after having long submitted to the influence of the places of habitation and the diverse habits which they have been made to contract in each country, they have experienced remarkable changes and have formed peculiar races. Now man, for the sake of commerce or for other interests, travels great distances; and having transported into well-peopled places, as a great capital, different races of dogs bred in countries far apart, and then crossed them, he has by generation given origin successively to all these which we now know.

The following fact proves, in regard to plants, how the change

of some important circumstance acts to change the parts of these living bodies. While *Ranunculus aquatilis* is immersed in water its leaves are all finely divided and the divisions are capillary, but when the stems of this plant reach the surface of the water, the leaves which develop in air are enlarged, rounded and simply lobed. If some root of this plant succeeds in pushing itself into a soil only damp, without being covered by water, the stems are short, and none of the leaves are parted into capillary lobes; it is called the *Ranunculus hederaceus*, which botanists regard as a species when they encounter it. There is no doubt that, in regard to animals, important changes in the circumstances in which they are in the habit of living, produce changes likewise in their parts, but here the mutations are slower in being brought about than in vegetables, and in consequence are less evident to us, and their cause less recognisable. Among the circumstances which have so much power to modify the organs of living bodies, the most influential are, without doubt, the diversity of places which they inhabit; but besides these are many others which have considerable influence in the production of the results in question. It is known that different places change nature and quality on account of their position, of their constitution, and of their climate. This is easily observed in visiting different places distinguished by these particular qualities. Behold, then, one cause of variation of animals and of vegetables which live in these diverse localities; but that which is not sufficiently known, and even what is generally refused credit, is that each locality itself changes in time, exposure, climate, nature and quality, though so slowly in comparison with our lifetimes that we attribute to it perfect stability. Now, in one and the other case, these changed localities change correspondingly the relations to living bodies which inhabit them, bringing to bear new influences on them. It is known that when there are extremes in these changes there are gradations which are intermediate, and which fill the interval. Consequently there are shades of difference, which distinguish what we call species. It is therefore evident that the entire surface of the globe shows, in its nature and in the situation of the materials which occupy different localities, a diversity of circumstances which is everywhere in relation with that of the forms and of the parts of animals, independent of peculiar diver-

sity which necessarily results from the progress of the composition of the organization in each animal.

In every place where animals have been able to live, the circumstances which have established there an order of things which has continued for a long time the same, and change is there really so slow that man has not been able to observe it directly. He is obliged to consult records, and monuments, and to recognize that in each one of these localities the order of things which he finds there has not always been the same, and thus to infer that it will still change. The races of animals which live in any of these places must preserve their habits for a long time, hence to us the apparent constancy of races which we call species—constancy which has given us the idea that these races are therefore as ancient as nature.

But at different points on the surface of the globe which are habitable, the nature and situation of the localities and the climates constitute for animals, as for vegetables, different circumstances in all kinds of degrees. Animals which inhabit these different localities must then necessarily become different from each other, not only by reason of the state of growth of the organization in each case, but besides by reason of habits which individuals of each race are forced to adopt. Therefore, in a measure, in traveling over great portions of the surface of the earth, the observing naturalist sees circumstances change in a gradual manner; he perceives constantly also that the species change proportionally in their characters. Now, the true order of things, which is the question to consider in all this, consists in recognizing,—

1st. That every change, of any importance, in the circumstances in which each race of animals exists, continually maintained, effects a real change in their necessities.

2d. That all change in the wants of animals necessitates for them new actions, in order to satisfy new wants, and consequently other habits.

3d. That every new want necessitating new actions to satisfy it, requires from the animal which experiences it, more frequent employment of some of its parts of which it made less use before. Thereby are developed and enlarged considerably the new parts which the wants have insensibly created in it by the efforts of its

"interior sentiment." This is the question, as I will presently prove by known facts. To arrive at a knowledge of the true causes of so many diverse forms and so many different habits, of which known animals offer us examples, it is necessary to consider that the infinitely diversified circumstances, but slowly changing, which the animals of each race are continually encountering, produce for each of them new wants and necessarily changes in their habits. Now this incontestable truth once acknowledged, it will be easy to perceive how these new wants could be satisfied, and these new habits assumed, if we give some attention to the two following laws of nature, which observation has always proved to be constant:—

First Law.—In every animal which has not passed the time of its development the frequent and sustained employment of an organ gradually strengthens it, developes and enlarges it, and gives it power proportional to the duration of its use; whilst the constant disuse of a like organ weakens it, insensibly deteriorates it, progressively reduces its functions, and finally causes it to disappear.

Second Law.—All that nature acquires or loses in individuals by the influence of circumstances to which the race has been exposed for a long time, and in consequence by the influence of the predominate employment of such organ, or by the influence of disuse of such part, she preserves by generation, among new individuals which spring from it, providing the acquired changes be common to both sexes, or to those which have produced new individuals.

These are, then, two constant truths which cannot be misconstrued, except by those who have never observed or followed nature in her operations, or by those who entertain an error which I will combat. Naturalists having remarked that the forms of the parts of animals are always perfectly in harmony with the use of those parts, have thought that the forms and the conditions of the parts had caused their employment. Now this is an error, for it is easy to demonstrate by observation that on the contrary it is the wants and uses of the parts which have developed these same parts, that they are made to exist where they did not, and that consequently they have given place to the condition in which we observe them in every animal.

For, had this not been so, it would be necessary that nature

should have created for the parts of the animal as many forms as the diversity of the circumstances in which they had to live would have required, and that these forms as these circumstances should never have varied. This is certainly not the order of things which exists, and if it were really such we would not have the race-horses of the form of those in England. We would not have great draught-horses, so heavy and so different from the former. For had not nature herself produced the like, we would not have, for the same reason, lapdogs with slender limbs, greyhounds so agile in running, water-dogs, etc. We would not have poultry without tails, peacocks, pigeons, etc.; finally we would not be able to cultivate wild plants, as we please, in the rich and fertile soil of our gardens, without fearing to see them change by long culture. For a long time there has been in this respect a sentiment which has established the following saying, which has passed into a proverb, which all the world knows, that "habits form a second nature." Surely if the habits and the nature of each animal never varied, the proverb would have been false, and would not have been used for the cases to which it had been applied.

If people considered seriously all that I have just shown, they would know that I was well grounded in reasons when, in my work entitled "Recherches sur les corps vivans," p. 50, I established the following proposition: "It is not the organ, that is to say, the nature and form of the parts of the body of an animal which have given origin to its habits and peculiar functions, but it is, on the contrary, its habits, its manner of life and the circumstances in which individuals from which it came, found themselves, which have after a time constituted the form of its body, the number and character of its organs, and finally the functions which it possesses. Let us weigh well this proposition, and give to it all the attention which nature and the condition of things continually gives us opportunity. Then its importance and its truth will become perfectly clear.

Time and favorable circumstances being, as I have already said, the two principal means which nature employs in giving existence to all her productions, it is evident that time has no limit for her, and in consequence she has it always at her disposal. Concerning these circumstances, which she requires, and which she still uses

every day, to change all that which she continues to produce, they are in many ways inexhaustible to her. The principal proceed from the influence of climates, from that of diverse temperatures of atmosphere, and of all the surrounding media; that of the diversity of places, and of their situation; that of habits, of the most ordinary movements, of the most frequent actions; finally, of that of the means of self-preservation, of manner of life, of defence, of multiplication, etc. Now, by continuance of these diverse influences the faculties become expanded and strengthened by use, become diversified by new habits long maintained, and insensibly the conformation, consistence, in a word, the nature and condition of parts, also that of organs, participate in all these influences, maintaining and propagating themselves by generation.

These truths, which are only the result of the two natural laws expounded above, are in all cases strictly confirmed by facts; they indicate clearly the progress of nature in the diversity of her productions. But in place of contenting ourselves with generalities which may be considered as hypothetical, let us examine strictly the facts, and consider, in animals, the result of the use or disuse of their organs upon these organs themselves. According to the habits which each race has been forced to contract, I will prove that the constant lack of exercise, as regards an organ, diminishes at first its functions, gradually impoverishes it, and in the end makes it disappear, or annihilates it; so this disuse perpetuates itself for a long time thereafter in successive generations of animals of the same race. Afterwards I will show that, on the contrary, the habitual exercise of an organ in any animal which has not experienced a diminution of its functions, not only perfects and increases its functions, but otherwise makes it acquire the development and dimensions which insensibly change it, so that after a time it renders it different from the corresponding organ of another animal which exercises it much less.

The disuse of an organ having resulted in the habits which it has assumed, gradually impoverishes the organ, and finally makes it disappear, or obliterates it. As such a proposition could be admitted only on proof, and not on simple declaration, we will attempt to make it evident by the citation of known facts which constitutes its basis.

Vertebrate animals, of which the plan of organization is nearly the same, although they show much diversity in their parts, have, usually, their jaws armed with teeth. Nevertheless those among them which circumstances have given the habit of swallowing their food without previous mastication have been found to display a repressed development of these parts—that these teeth have even remained hidden between the osseous plates of the jaws without being able to appear, or all traces of them have entirely disappeared. Among whales, which people have believed completely deprived of teeth, M. Geoffroy has found them hidden in the jaws of the fœtus. This professor has also found in birds the groove where teeth should have been placed, but nothing more has been seen. In the class Mammalia, which embraces the most perfect animals, and principally those of which the plan of organization of the vertebræ is most completely executed, not only the whale has no teeth for its use, but one finds also in the same condition the ant-eater (Myrmecophaga), in which the habit of not masticating its food has been introduced and preserved for a long time in its race Eyes in the head is the rule for a great number of diverse animals, and are essential to the plan of the organization of vertebrates. Nevertheless the mole, which by its habits has very little occasion to see, has only very small eyes, and which scarcely show, because it exercises this organ very little.

"The Spalax d'Olivier" (Voyage en Egypt et en Persia, II., pl. 82, f. 2), which lives under ground like a mole, and which is probably less exposed to the light of day, and has totally lost the function of sight, shows scarcely the rudiments of the organ which is its seat, and these vestiges are entirely hidden under the skin and under whatever other parts which cover it, which allow no access ot light. The Proteus, an aquatic reptile, cousin of the salamander, by all accounts lives in deep and obscure caverns, which are under ground, has, like the Spalax, only the traces of the organ of sight, which are covered and hidden in the same manner. Behold one decisive consideration relative to the question which I now discuss. Light does not penetrate everywhere, consequently animals which live habitually in those places where it does not come, lack occasion to exercise the organ of sight, if nature has provided them with it. Now, animals which partake in a plan of organization

in which eyes necessarily enter, must have originally had them. And, since one finds among them species which are deprived of these organs, and which have only traces, hidden and covered, it becomes evident that the impoverishment and even the disappearance of the organ in question is the result of constant disuse.

[To be continued.]

ON THE GLACIAL DRIFT AND LOESS OF A PORTION OF THE NORTHERN-CENTRAL BASIN OF IOWA.

BY CLEMENT L. WEBSTER.

THE region under consideration may include Floyd county, and portions of Cerro Gordo, Worth, Mitchell, Chickasaw, Bremer, Butler, and Black Hawk counties. The general topography of this region is that of a gently undulating prairie country, with often a more or less broken surface along the course of the streams. Portions of Worth, Chickasaw and Bremer counties are low and rather wet, while that of other portions of the area are dryer and more rolling. The western portion of this region is drained mainly by Flood and Lime creeks and the Shellrock river, while the eastern portion is drained by the Cedar and Wapsipinecan rivers and their affluents.

All the streams of the area have a general northwest and southeast trend; their initial direction having been predetermined by the general dip of the subjacent rock strata. The Shellrock and Lime creeks have, for the most part, in their course through this region, eroded their channels through the drift, and into the underlying Devonian strata to a depth varying from five to seventy feet. The Cedar has cut through the drift, and sunk into the underlying rocks to a depth of from ten feet to over one hundred feet. The Wapsipinecan river and Flood creek flow through this country mostly upon the drift formation. The valleys

of the streams of this area are usually broad, with one side more or less well defined, while the opposite side gradually emerges into the adjoining upland.

By far the greater portion of the surface of the area is occupied by the drift formation, which varies much in thickness at different localities. The difference seems to be partially due to original deposition, and partially to subsequent erosion. A line drawn from Waterloo, in Black Hawk county, in a northwest direction to Mason City, in Cerro Gordo county, and another line drawn from Waterloo to Osage, in Mitchell county, would include within their boundary the area of the thinnest drift of the region, and, indeed, of Iowa. In all parts of this attenuated drift area, the underlying rock strata is exposed at the surface in very numerous places.

Present evidence seems to indicate that the superficial geological formation of this entire region shows two main Glacial epochs, each of which is characterized by several subdivisions. As belonging to the earlier Glacial epoch, there are recognized two drift sheets. Between these occur, at numerous points in the area, and other portions of the State, vegetal accumulations, indicating a non-glacial interval. This horizon is usually referred to as the "Old Forest Bed." The material of the lower and upper drift sheets is (so far as observed) essentially the same, being composed for the most part of a heavy, dark blue clay, containing a greater or less number of transported deangulated erratics and pebbles, numbers of them being in a partially decomposed condition. At some points the clay of these beds is distinctly stratified, and as readily separated into layers as ordinary limestone.

The vegetal accumulation which occupies a horizon between these drift sheets is composed of coniferous wood, branches and twigs, which is very often associated with ancient peat, and more or less mixed with the drift. In digging wells in this division, natural gas is often obtained,[1] this originating from the organic accumulation. Gathering evidence seems to demonstrate that the vegetal accumulation of this region, as well as that of some other places in the State, are referable to a single horizon.

[1] In an article on "The Geology of Johnson county, Iowa," which appeared in the May number of this Journal for 1888, mention was made, by the writer, of wells of this character in Linn county, Iowa.

As belonging to the later Glacial epoch, we recognize three divisions: the Upland, or (for the most part) unstratified drift; Valley, or stratified drift; and Loess. The Upland drift constitutes by far the greater bulk of the superficial covering of the region. Its material is mainly true till, with local deposits or pockets of coarse gravel and sand, which is sometimes slightly cemented together by calcareous cement, and large numbers of transported erratics. There also occur local deposits of stiff red clay; for example, near Floyd, Nora Springs, and Rockford, in Floyd county.

These deposits of clay are usually quite free from erratics, gravel or sand, has a soapy feel, and becomes very hard upon short exposure to the atmosphere. The gravel deposits of this division are not restricted to any definite horizon, but are irregularly distributed through it. The material is usually well rounded pebbles of several varieties of greenstone, quartz (much of it probably of Cretaceous origin), granite, Devonian limestone, jasper, etc. There also sometimes occur specimens of coal, native copper and iron,[1] as well as Devonian and Trenton fossils. Large numbers of deangulated granite and greenstone boulders, and more rarely those of quartz, are seen distributed over the surface and mixed with the till. The boulders vary in weight from two pounds to ten or twenty tons; of the latter, fine examples are observed near Portland, Osage, Nashua, and other places.

In some parts of the area, angular fragments of Cretaceous conglomerate are not uncommon in the drift. This material was probably derived, at least in part, from the southwest portion of Floyd county, where rocks of this age are known to occur in place.[2] The material of this division is usually unstratified, but at times it is observed to be obliquely and discordantly stratified at high points, distant from waterways.

The region of most numerous erratics is that of the eastern portion of the area. A strip of country from one-half to four miles in width is occupied by great numbers of boulders, mostly of granite and green-

[1] The occurrence of these ores, etc., in the drift of this region, was noted by the writer in a paper on "The Glacial Flow in Iowa," which appeared in the August number of this Journal for 1887.

[2] A description of this rock has been given by us in a paper on "A Description of the Rockford Shales of Iowa," which appears in Vol. VI. of the Proceedings of the Davenport Academy of Science.

stone. This boulder line has been traced by us from a point about one mile northeast from Charles City, in Floyd county, to a little east of Waterloo, a distance of about fifty miles. Below this point we have not traced it; neither have personal observations of it been made beyond Charles City. It has been reported to me, however, that from Charles City the boulder line extends in an easterly direction to a point near Fort Atkinson, in Winneshiek county, and there turns and pursues a more northerly course. From Charles City this boulder line takes a general southeast course, passing about two miles east of Nashua, in Chickasaw county, where it attains its greatest observed width, four miles. From this point it assumes a somewhat more easterly direction, and gradually diminishes in width. At a point midway between Richland Centre and Frederica, it again turns and pursues a more southerly course to Waterloo; the direction corresponding in the main with the general trend of the Wapsipinecan and Cedar rivers. In some localities, for example, Richland Centre, Frederica, etc., breaks in this line occur, from one-fourth to one-half mile in extent, where the erratics are relatively rare, but which soon appear again in strong force.[1] An interesting and instructive feature of these boulders is, that they are all (so far as noticed) deangulated, smooth, and very hard, while large numbers of them are flattened and striated on one side by glacial action. This feature is shared in to no such extent by the erratics of other portions of the area. The second recognized division of the later Glacial epoch is the Valley, or stratified drift. Of the river valleys of this region, only one is known to contain true Valley drift; and this the valley of the Shellrock.

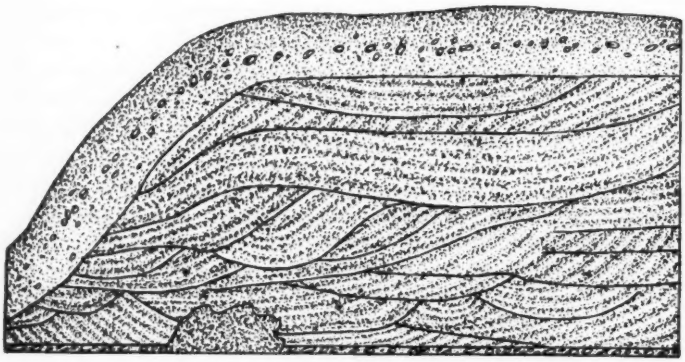
Although at different places along the course of some of the streams, local deposits of more or less distinctly stratified drift occur, still, as a rule, this feature is no more pronounced than at some points in the Upland drift. The Shellrock heads near Lake Albert Lea, Minnesota, and flows into this sheet of water at its upper extremity, and makes its exit at its lower or southern extremity. This sheet of water occupies a depression in the Inter-lobular moraine which enters Iowa. The Shellrock flows upon this heterogeneous drift accumulation for a distance of ten miles, and

[1] Owing to the lack of other rock here for building purposes, the boulders are extensively used for underpinning, well and cellar walls, bridge piers, etc., for which they answer a most excellent purpose.

in reality does not reach the subjacent rock strata (except at two or three points) until Plymouth, in Cerro Gordo county, Iowa, is reached. From this point to its confluence with the Cedar, fifty-seven miles below, it has eroded its channel down through the drift formation, and flows upon the underlying Devonian strata.

Stretching away from the morainic border, and partially filling the valley of the Shellrock, is a train of Valley drift, which extends to the confluence of this stream with the Cedar, seventy-two miles below. This morainic border lies upon rolling country, and there leads away from it, in portions of Cerro Gordo and Worth counties, valleys or trough-shaped depressions of notable size, which we should naturally expect would have drawn very considerable drainage floods from the margin of the ice. The material of this formation is usually well rounded, coarse and fine gravel and silicious sand, not essentially differing from the Upland drift gravel, except that it contains a very much larger percent-

FIG. 1.



age of silicious sand, and does not usually contain any perceptible admixture of clay. The material (except the very coarse portion) is everywhere obliquely and discordantly stratified. This feature is well illustrated in the following sections.

Fig. 1 represents a section of Valley drift at Rockford, illustrating the flow and plunge style of stratification. The material is mostly fine

silicious sand, with a layer of coarse rounded gravel at the bottom, resting upon Devonian strata. The upper bed is a fine silt-like soil, mixed with coarse drift gravel, due in part to secondary accumulation arising from wash from a slight adjoining slope. The talus of sand at the base conceals several subordinate beds.

FIG. 2.

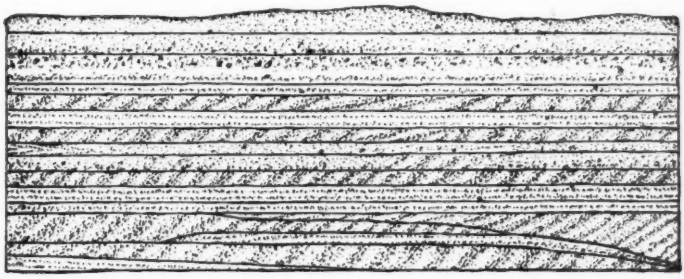


Fig. 2 represents a section of Valley drift near Nora Springs, illustrating oblique stratification. The material is well rounded gravel and sand. The upper bed is a black homogeneous silt, containing a few small drift pebbles. The second bed is a yellow clayey soil, with some fine gravel in the lower portion.[1] The next succeeding bed is partially stratified gravel and sand. The wave-like parts of Figure 1 correspond to succeeding plunges in the rapidly flowing waters, and indicates a much more turbulent condition of the water than when the material of Figure 2 was deposited.

At Clarksville, in Butler county, and other places, the Valley drift is seen to be obliquely stratified, the same as near Nora Springs. The gravel of this division at different points has been more or less solidified by calcareous cement. An interesting feature of this formation is that very often a large percentage of the finer material occupies the lowest position, while the coarser material often occupies the higher position.

Fine examples of terraces are observed along the streams of this region; for example, on the west side of the Cedar, a few miles above Waverly; on the west side of the Shellrock, two

[1] These beds well illustrate the condition of the first few feet of the superficial accumulation of nearly all parts of the area under consideration.

and one-half miles northwest from Rockford; on the east and west sides of Linn creek, one and one-half miles west of Rockford, and other places. These terraces appear to have been formed by the contracting and deepening of the channels of these streams by their own waters.

The last recognized division of the later Glacial epoch is the Loess formation. This formation is represented by only a few limited outliers at different points along the course of the Cedar river. On the west side of the Cedar, at Mitchell, in Mitchell county, is a local deposit of very fine and homogeneous, typical yellow loess, having a thickness of twelve feet. This rests directly upon a layer (from four to six inches in thickness) of clean rounded and angular drift pebbles, and the pebbles in turn rest (in places) upon a very dark, ferruginous layer of rock, which lays upon broken-up Devonian limestone below.

In the lower portion of the exposure of loess, one or two large shells was found, which were, however, in a too imperfect state of preservation for satisfactory determination. On the east side of the Cedar, one mile above Floyd, another outlier of this formation occurs. The loess at this place is like that observed at Mitchell, except that it contains small quantities of silicious sand in places, and in places has a very slight blueish-gray shade. The greatest observed thickness of this exposure was, by estimate, twenty-one feet. No drift was seen to intervene between the loess and the coarse-grained calcareo-silicious sandstone below.[1] The surface of the rock at this place rises to a height of over one hundred feet above the water in the Cedar.

The locality where this formation is next observed is on the same stream, at Waverley, about thirty-two miles below Floyd. The loess here (so far as ascertained) is light yellow, fine-grained and homogeneous, but contains at one point a very large amount of dark, grayish-brown silicious sand. No fossils, concretions, or ferruginous tubules was noticed in the loess of this place.

Probably no department of geological investigation has greater

[1] This sandstone attains a thickness of two feet, and rests upon very hard and fine-grained, grayish-white Devonian limestone. No sandstone exactly like this is known to occur at any other point in northern Iowa.

need of careful criticism than that which deals with the complex deposits of the Glacial period. Nowhere, perhaps, is there need of closer examination, and nowhere, probably, is the discrimination more difficult than in drawing the line between the earlier Glacial epoch and the later Glacial epoch of the area which has been under consideration.

HISTORY OF GARDEN VEGETABLES.

BY E. LEWIS STURTEVANT, M.D.

(Continued from page 808.)

Kohl-rabi. *Brassica oleracea caulo-rapa*, D C.

I FIND no certain identification of this race in the ancient writings. The *bunidia* of Pliny[1] seems rather to be the ruta baga, as he says it is between a *radish* and a *rape*. The *goggulis* of Theophrastus[2] and Galen[3] seems also to be the rutabaga, for Galen says the root contained *within* the earth is hard, unless cooked. In 1558 Matthiolus[4] speaks of the kohl-rabi as having lately came into Germany from Italy. Between 1573 and 1575 Rauwolf[5] saw it in the gardens of Tripoli and Aleppo. Lobel[6] in 1570, Camerarius[7] in 1586, Dalechamp[8] in 1587, and other of the older botanists, all figure or describe it as under European culture. This plant, in the view of some writers, is a cross between the cabbage and the rape, and many of the names applied to it convey this idea. This view is probably a mistaken one, as the plant in its sportings under culture tends to the form of the marrow cabbage, from which it is probably a derivation. In 1884, in two plants in pots in the

[1] Pliny. Lib. xx., c. 2.
[2] Theophrastus. Lib. vii., c. 4.
[3] Galen. De Alim.
[4] Matthiolus Comm., 1558, 248.
[5] Gronovius. Orient., 81.
[6] Pena and Lobel. Adv., 1570, 92.
[7] Camerarius. Epit., 1586, 251.
[8] Hist. Gen. Lugd., 1587, 522.

green-house, I had good kohl-rabi bulbs, and one of these extended itself until it became a marrow cabbage, and when planted out in the spring attained its growth as a marrow cabbage. This idea of its origin finds countenance in the figures of the older botanists; thus Camerarius, in 1586, figures a plant as a kohl rabi which in all essential points resembles a marrow cabbage, being tapering from a small stem into a long kohl rabi, with a flat top like the marrow cabbage. The figures given by Lobel,[1] in 1591, Dodonæus,[2] in 1616, and Bodæus,[3] in 1644, when compared with Camerarius' figure, suggest the marrow cabbage. A long highly improved form, not now under culture, is figured by Gerarde,[4] in 1597, J. Bauhin,[5] in 1651, and Chabræus,[6] in 1677, and the modern form is given by Gerarde, and by Matthiolus[7] in 1598. A very unimproved form, out of harmony with the other figures, is given by Dalechamp,[8] in 1587, and Castor Durante,[9] in 1617.

This synonymy can be tabulated in order as below:—

1. Caulorapum. Cam. epit., 1586, 251.

2. { Rapa, Br. peregrina, caule rapum gerens. Lob. ic., 1591, 246.
   Br. caule rapum gerens. Dod. pempt., 1616, 625.
   Rapa brassica. Bodæus, 1644, 777.

3. { Caulo rapum longum. Ger., 1597, 250.
   Br. caulorapa. J. Bauh., 1651, ii., 830.
   Br. caulorapa sive Rapo caulis. Chabr., 1677, 270.

4. { Caulorapum rotundum. Ger., 1597, 250.
   Brassica gongylodes. Matth. op., 1598, 367.

5. { Brassica raposa. Lugd., 1587, 522.
   Bradica raposa. Cast. Dur., 1617, app.

Matthiolus, as we have stated, says the plant came into Germany from Italy; Pena and Lobel say it came from Greece; Gerarde, that it groweth in Italy, Spain and Germany, from whence he

[1] Lobel. Ic., 1591, 246.
[2] Dodonæus. Pempt., 1616, 625.
[3] Bodæus a Stapel. Theophrastus, 1644, 777.
[4] Gerarde. Herb., 1597, 250.
[5] J. Bauhin. Hist., 1651, ii., 830.
[6] Chabræus. Ic. et Sci. ag. 1677, 270.
[7] Matthiolus. Op., 1598, 367.
[8] Castor Durante. Herb., 1617, app.
[9] Fessenden. New Am. Gard., 1828, 59.

received seeds. These excerpts indicate a southern origin for this vegetable, and the marrow cabbages are very sensitive to cold. The more highly improved forms, as figured in our synonymy, are in authors of northern or central Europe, while the unimproved forms are given by more southern writers. This indicates that the present kohl rabi received its development in northern countries.

The varieties now grown are the white and purple, in early and late forms, the curled leaf, or Neapolitan, and the artichoke-leaved. One, at least, was in American gardens as early as 1806, and the rest appear before 1863.

The nomenclature of this plant is deserving of attention, from the presence of foreign words, for which its history seems to afford but little justification.

The *kohl-rabi, Turnip-rooted cabbage, Arabian, cole rape, cole turnip, Cape cabbage,*[1] or *Hungarian turnip,* is called in France *choux-raves, chou de Siam, boule de Siam;* in Germany, *oberkohl-rabi;* in Flanders, *raapkool;* in Holland, *koolraapen boven den grond;* in Denmark, *overjordisk kahlrabi, kundekaal;* in Italy, *cavolo rapa, torsi;* in Spain, *col rabanho;* in Portugal, *couve rabano, couve de Siam;*[2] in Norway, *overjords-kaalrabi;*[3] in India, *ole kole,* or *gool jur ka kuhun.*[4]

Lavender. *Lavandula vera* D C.

Lavender is sometimes grown for the use of the leaves as a condiment, but more often for the flowers, which find use in perfumery; but we have never heard of its being grown on a large scale in the United States, although it was in garden culture in 1806. Its present growing is doubtless very insignificant.

There is no satisfactory identification of lavender in the writings of the ancients, although it seems to have been well known to the botanists of the sixteenth century, and the use of the perfume was indicated as early as the fourteenth century, and as a medicine even in the twelfth century.[6] Its seed was in English seedsmen's lists of 1726,[7] for garden culture.

[1] Townsend, seedsman, 1726, 28.
[2] Dodonæus. Gard. Dict., 1831, i., 228.
[3] Vilmorin. Les Pl. Pot., 1883, 139.
[4] Schubeler. Culturp. f. de Norw., 105.
[5] Speede. Ind. Handb. of Gard., 1842, 140.
[6] See Pharmacographia, 1879, 476.
[7] Townsend, seedsman, 1726, 37.

Lavender is called in France *lavande, aspic, lavande femelle;* in Germany, *lavendel, spike;* in Flanders, *lavendel;* in Denmark, *lavendel;* in Italy, *lavanda;* in Spain, *espliego.*[1]

Lavandula spica L., a more southern species, is confounded with the above in cultivation, and is also cultivated on a large scale for purposes of distillation. Mawe, in 1778, named four varieties, the narrow-leaved with blue flowers, the narrow-leaved with white flowers, the broad-leaved and the Dwarf.

Leek. *Allium porrum* L.

This vegetable was the *prason* of the ancient Greeks, the *porrum* of the Romans, who distinguished two kinds, the *capitatum*, or leek, and the *sectilis*, or chives, perhaps, although Columella,[2] Pliny[3] and Palladius[4] indicate these as forms of the same plant brought about through difference of culture, the chive-like form being produced by thick planting. They seem to have been very popular at Rome. In Europe the leek was generally known throughout the middle ages, and in the earlier botanies some of the figures of the leek represent the two kinds of planting alluded to by the Roman writers. In England, in 1726, Townsend[5] says that "leeks are mightily used in the kitchen for broths and sauces." When they reached America I do not find recorded, but prior to 1775 they were grown at Mobile, Ala., and were cultivated by the Choctaw Indians.[6]

The leek may vary considerably by culture, and often attains quite a large size; one with the blanched portion a foot long and nine inches in circumference, and the leaf fifteen inches in breadth and three feet in length, has been recorded.[7] Vilmorin[8] described eight varieties in 1883, but some of these are scarcely distinct.

The *leek*, or *porret*,[9] is called in France *poireau, poiree, poirette, porreau;* in Flanders and Holland, *prei;* in Germany, *lauch, por-*

[1] Vilmorin. Les Pl. Pot., 1883, 318.
[2] Columella. Lib. ii., c. 8.
[3] Pliny. Lib. xix., c. 34.
[4] Palladius. Lib. iii., c. 24.
[5] Townsend. 1726, 37.
[6] Romans. Nat. Hist. of Fla., i., 115. 84.
[7] Gard. Chron., Nov. 6, 1886, 599.
[8] Les Pl. Pot., 1883, 416.
[9] Ray. Hist., 1688, 1126.

ree; in Denmark, *porre;* in Italy, *porro;* in Spain, *puerro;* in Portugal, *alho porro;* in Greece, *to prasa;* in Sweden, *puris;*[1] in Russia, *pras;*[2] in Norway, *purre.*[3] In Arabic, *karrat,*[4] or *kournas;* in Bengali, *puroo;* in Egypt, *korrat;*[5] in India, *kundaneh, zalook* or *puroo;*[6] in Persian, *gundena.*[5]

This species is supposed by authors to be a cultivated form of *Allium ampeloprasum* L.

Lentil. *Ervum lens* L.

The cultivation of the Lentil is very ancient, as it has been found in the Egyptian tombs of the twelfth dynasty, or 2,200 to 2,400 B.C.[7] It has also been found in the lacustrine debris of Switzerland dating from the age of bronze.[8] Its culture was well known to the ancient Greeks and Romans, and has been continued through the middle ages to the present time. Bauhin,[9] in 1623, names a large and a small sort, the seed reddish, pale yellow, white, tawny and black, and Vilmorin,[10] in 1883, describes four varieties for garden culture. Its seed is used in soups and stews, and the culture is of more importance in the warmer regions. Lentils are recorded by Burr,[11] in 1863, for American use; but much of the seed found exposed for sale in groceries is imported.

The *lentil* is called in France *lentille, arousse, aroufle;* in Germany, *linse;* in Flanders and Holland, *linze;* in Denmark, *lindse;* in Italy, *lente, lenticchia;* in Spain, *lenteja;* in Portugal, *lentilha.*[10] In Arabic, *a'ds;*[12] in Egypt, *adz;* in India, *mussoor;* in Sanscrit, *mussoora;*[13] in Latin, *lens;* in Slav, *lesha;* in Illyrian, *lechja;* in Lithuanian, *lenszic;* the Greeks, *fakos* or *fakai;* the Berbers, *ades.*[8]

[1] Decandolle. Geog. Bot., 848.
[2] McIntosh. Book of the Gard., ii., 47.
[3] Schubeler. Cult. Pflanz den Norw., 53.
[4] Delile. Fl. Æg. Ill.
[5] Birdwood. Veg. Prod. of Bomb., 186.
[6] Speede. Ind. Handb. of Gard., 158.
[7] Schweinfurth. Nature, Jan. 31, 1883, 314.
[8] Decandolle. Orig. des Pl. Cult., 258.
[9] Bauhin. Pin., 1623, 346.
[10] Vilmorin. Les Pl. Pot., 318.
[11] Burr. Field and Gard. Veg., 1863.
[12] Delile. Fl. Ægypt. Illust.
[13] Birdwood. Veg. Prod. of Bomb., 119.

Lettuce. *Lactuca sativa* L.

This, the best of all salad plants, as a cultivated plant has a high antiquity. It is evident, by an anecdote related by Herodotus, that it appeared at the royal tables of the Persian kings about 550 B.C.[1] The medicinal properties as a food-plant was noted by Hippocrates,[2] 430 B.C., praised by Aristotles,[3] 356 B.C., and the species described by Theophrastus,[4] 322 B.C., Dioscorides,[5] 60 A.D., and mentioned by Galen,[6] 164 A.D., who gives an idea of a very general use. Among the Romans it was very popular. Columella,[7] A.D. 42, describes the Cæcilian, Cappadocian, Cyprian and Tartesan. Pliny,[8] A.D. 79, enumerates the alba, Cæcilian, Cappadocian, crispa, Græca, Laconicon, nigra, purpurea and rubens. Palladius,[9] 210 A.D., implies varieties, and mentions the process of blanching. Martial,[10] A.D. 101, gives to the lettuces of Cappadocia the term *viles*, or cheap, implying abundance. In China its presence can be identified in the fifth century.[11] In England, Chaucer, about 1340, uses the word in his prologue, "well loved he garlic, onions and lettics," and it is likewise mentioned by Turner,[12] in 1538, who spells the word *lettuse*. It is mentioned as cultivated in Isabella Island, in 1494, by Peter Martyr,[13] as also in Mexico at a later date; is noted as abundant in Hayti in 1565,[14] etc.

In the report of the New York Agricultural Experiment Station for 1885, eighty-seven varieties are fully described with 585 names or synonyms. Vilmorin[15] describes, in 1883, one hundred and thirteen kinds as distinct. The number of varieties named by various writers at various times are as follows: For France, in

[1] McIntosh. Book of the Gard., ii., 5.
Hippocrates, Cornarius ed., Paris, 1546, 113.
[3] Scaliger. De Plant.; Arist., 1566, 63, etc.
[4] Theophrastus, Bodæns ed., 1644, 761.
[5] Dioscorides, Vergelius ed., 1532, 220; Ruellius ed., 1529, 130.
[6] Galen. De Alim., lib. ii.; Gregorius ed., 1547, 143.
[7] Columella, lib. x., c. 181–193, 369.
[8] Pliny, lib. xix., c. 38.
[9] Palladius, lib. ii., c. 14; lib. iii., c. 24; lib. iv., c. 9, etc.
[10] Martial, lib. v., 79.
[11] Bretschneider. Bot. Sin., 78.
[12] Turner. Libellus, 1538.
[13] Edens Hist. of Trav., 1577.
[14] Benzoni. Hist. of the New World, Smythe ed., 1857.
[15] Vilmorin. Les Pl. Pot., 1883.

1612, six; in 1690, twenty-one; in 1829, forty; in 1883, one hundred and thirteen. For Holland, in 1720, forty-seven. For England, in 1597, six; in 1629, nine; in 1726, nine; in 1763, fifteen; in 1765, eighteen; in 1807, fourteen. In America, in 1806, sixteen; in 1885, eighty-seven.

The cabbage and cos lettuces are the sorts now principally grown, but various other kinds, such as the curled, are frequently, and the sharp-leaved, oak-leaved, etc., occasionally, as novelties.

In this large class, I shall content myself with offering the synonymy of a few of the varieties now known, and which shall indicate the antiquity of our cultivated types.

I. The Lanceolate-leaved Type.

Lactuca longifolia. Bauh. phytopin., 1596, 200.
Lattuga franzese. Cast. Dur., 1617, 244, cum ic.
Lactuca folio oblongo acuto. Bauh. pin., 1623, 125; prod., 1671, 60, cum ic.
Lactuca longo at valde angusto folio. J. Bauh., 1651, ii., 999, cum ic.; Chabr., 1677, 313, cum ic.
Deer Tongue. Greg., 1883.

II. The Cos Type.

Pena and Lobel,[1] in 1570, say that this form is but rarely grown in France and Germany, although common in the gardens of Italy; and Heuze[2] says it was brought from Rome to France by Rabelais in 1537.

Lactura florescens. Cam. epit., 1586, 299, cum ic.
Lactuca intybacea, Lombard Lettuce. Ger., 1597, 240, cum ic.
Lactuca foliis endiviæ. Matth. op., 1598, 399, cum ic.
Lactuca Romana longa dulcis. J. Bauh., 1651, ii., 998, cum ic.; Chabr., 1677, 313, cum ic.
La Romaine. Le Jard. Solit., 1612.
Romaines. Vil,, 1883, 307.

We can reasonably believe the lettuce of Camerarius to be very close to the Florence Cos. The Lombard lettuce was grown as a sport in the garden of the New York Agricultural Experiment Station, in 1886, and the figures by Bauhin and Chabræus may well be the Paris Cos. I would not be understood, however, as imply-

[1] Pena and Lobel. Adv., 1570, 90.
[2] Heuze. Les Pl. Alim., i., v.

ing that these figures represent the improved forms of our present culture, but as the prototypes from which our plants have appeared, as shown not only by resemblance of leaf form, but through the study of variables in the garden. Ray, in 1686, describes the Cos as having light green and dark green varieties, and these, as well as the Spotted Cos, are indicated by Bauhin in 1623.

III. The Headed Lettuce.

This is the sort commonly grown, and the figures given in the sixteenth century indicate that the heading habit was even then firmly established. We have the following synonyms to offer, premising that types are referred to, and not exact variety resemblance:—

a.

Lactuca crispa. Matth., 1558, 264; Pin., 1561, 195.
Lattuga. Cast. Dur., 1617, 243.
La royale? Le Jard. Solit., 1612; Quintyne, 1690, etc.
Laitve Blonde de Berlin, syn. Laitve royale. Vil., 1883, 295.
Berlin.

b.

Lactuca sativa sessilis sive capitata. Lob. ic., 1591, i., 242.
Lactuca capitata. Dod., 1616, 645.
Very Early Dwarf Green.

c.

Lactuca. Cam. epit., 1586, 298.
Lactuca capitata. Ger., 1597, 240.
Lactuca crispa. Matth. op., 1598, 399.
Batavians. Vil., 1883.

d.

Lattich. Roszlin, 1550, 167.
Green Fringed.

This latter identification is from the appearance of the young plant. The old plant is remarkably different, forming a true rosette.

IV. Cutting and Miscellaneous.

a.

Lactuca crispa altera. Ger., 1597, 240.
Lactuca crispa et tenuiter dissecta. J. Bauh., 1651, ii., 1000; Chabr., 1677, 314.
Curled Cutting.

b.

Lactuca foliis querni. Ray, 1686, 219.
Oak-leaved.

c.

Capitatam cum pluribus capitibus. J. Bauh., 1651, ii., 998; Chabr., 1677, 313.
Egyptian Sprouting.

The minor variations which are now separated into varieties did not receive the same recognition in former times, the same variety name covering what now would be several varieties; thus Quintyne, in 1693, calls perpignans both a green and a pale form, etc. Green, light green, dark green, red and spotted lettuces are named in the old botanies; hence we cannot assert any new types have appeared in modern culture.

The generic names of the *lettuce* in the various languages are: in Greek, *thridakine, thridakinos, thridax hemeros;* in Latin, *Lactuca;*[1] in France, *laitue cultivee;* in Germany, *lattich;* in Flanders and Holland, *latouw;* in Denmark, *salat;* in Italy, *lattuga;* in Spain, *lechuga, ensiam;* in Portugal, *alface;*[2] in Sweden, Denmark and Russia, *laktuk;*[3] in Norway, *salat;*[4] in Arabic, *khass*[5] or *khus;*[6] in Ceylon, *salada;*[7] in China, *ye tsai, kiu,*[8] *sheng-tsai, pai-ku;*[9] in Cochin China, *rau, diep tau;*[8] in Egypt, *chaff;* in Hindustani, *kahoo;*[7] in India, *kahoo;*[10] in Japan, *kantats, futsu kusa, too tsisa.*[11]

[1] Grandsagne Pliny. Notes, xii., 354.
[2] Vilmorin. Les Pl. Pot., 285.
[3] Miller's Dict., 1807.
[4] Schubeler. Cult. Pfl. den Norw., 85.
[5] Delile. Fl. Æg. Ill.
[6] Wilkinson. Anc. Egypt, ii., 22.
[7] Birdwood. Veg. Prod. of Bomb., 49, 165.
[8] Loureiro. Fl. Cochinch., 479.
[9] Bretschneider. On the Study, etc., 17.
[10] Speede. Ind. Handb. of Gard., 166.
[11] Kæmpfer. Amœn., 1712, 831.

THE WESTERN SOCIETY OF NATURALISTS.[1]

BY S. A. FORBES.

THE first presidential address of a new society may well have for its subject the society itself; and the first duty of those responsible for such a society is to show its right to exist. There is only so much social power available for social purposes; why should we string a new belt to the already heavily burdened shaft, and tax the groaning engine with the movement of a new machine? Shall we interrupt and weaken the action of any existing agencies by this additional draft on the common stock of energy? or may we believe, on the contrary, that the final effect of our organization will be to increase the energy and activity of the whole apparatus; that it will react, in time, to supply power greater than that which it abstracts? In short, what are the objects and purposed uses of this Society of Western Naturalists? first, as to its own members; and second, as to society at large. These questions I shall endeavor to answer—not authoritatively—for only the Society can speak with authority for itself—but by way of interpretation and personal suggestion, hoping at least to raise questions concerning our scope, intention, and relations, which you may answer finally according to the common wish and judgment.

It seems proper, first, to say that in asking these questions, and in my attempts to answer them, I have in mind the present time, place, and conditions; that I shall not treat of the work which this Society might and should perform if it were established in Europe, or on the Atlantic seaboard, or if it were working in the twentieth century, but I shall inquire what are the ways in which we can most and best advance the study of our subjects in the present time and the immediate future, taking as our starting point the state of knowledge, the conditions of progress, and the special problems presenting themselves now in the northern half of the Mississippi valley.

And first, I remark, in phrase now temporarily classic, that "it is a condition and not a theory that confronts us." In the course

[1] Presidential address delivered at Champaign, Ill., October 24, 1888.

ot the development of science in this region, the easy things have in great part been done. The glittering sands have been largely passed through the cradle of the pioneer miner; the easily worked ores have been more or less thoroughly extracted, and we are fast approaching, if we have not already reached, the period when accumulated capital, powerful and complicated machinery, and the expert skill of the mining engineer are indispensable to the further development of our natural wealth. When a morning walk along the banks of the Wabash would give a Say new objects enough to keep him happily busy for weeks; when the moderately careful search of a single orchard or garden would yield to Fitch or Walsh, or the boyish Riley, material enough for an elaborate report; when the virgin soil of natural science only needed to be tickled with a hoe to laugh with a harvest, the question of methods and apparatus was one of quite subordinate importance. Little method and less machinery were needed to make a man useful and even eminent. And as for the educational problems with which we now have to deal, they gave the least imaginable concern, because they were practically non-existent. Until the movement for an industrial education based on science began, like a great ground swell, to heave the quiet surface, and until the tidal wave of popular interest and personal enthusiasm, set in motion by the elder Agassiz at Cambridge, swept across the West, the question of methods of instruction in natural history in school or college stood scarcely higher in the general estimation than that of the study of the language of the inhabitants of Mars. No one troubled himself about either. But since then, progress has been positive and really rapid, as those can best believe who have felt the full lift of the surge—has come with a speed accelerated, in fact, by the coincidence of three great movements.

First, the onward movement of the natural sciences themselves—a growth which is the continual astonishment of every intelligent observer, and the despair of all but the ablest and most active students.

Second, the movement of growth and development in this nterior region, relatively new, and newest of all in matters of science—this again a movement phenomenal in the history of the world.

And third, the progress resulting from the substitution of a younger and more highly educated working generation for an older one largely without special training.

From all this has come a recent change of status and surroundings, a modification of standards, a shifting of purposes and responsibilities, an accession of ideas, and a multiplication of duties, such as to compel us to consider the situation anew, and to urgently require a reorganization, along new lines, of whatever strength we can muster. In brief, the old machinery of scientific organization and development here in the West is much of it obsolete and inactive, and, taken as a whole, it is insufficient for the present day. The field of operation proposed by our Society—that of the improvement of methods of work, study, and instruction, is newly opened up to us by the rapid multiplication and complication of our subjects. The work we shall do is largely a new work, laid upon us as a condition of further symmetrical growth; and its performance is a duty which the promoters and curators of science and education in this region can avoid only at their own peril, and to the injury of the interests for which they have made themselves responsible.

If we look now to the benefits which we as individuals may hope to derive from our meetings, I count as most important some of those which are perhaps least obvious.

We are distinguished especially as a Society by an attention to methods rather than to results. That each worker should be deeply interested in whatever improvements of method are brought to light in his own field goes without saying, for in scientific research the method is, next to the man, the most important thing; the quality of the result depends on the choice of it, and the quantity upon that ready familiarity with it which makes every stroke tell to the best advantage; but if this were all, we should find ourselves splitting up into little sections of specialists, each indifferent to the other; or resolving ourselves, as an alternative, into a mutual toleration society, each group bearing patiently with the discussions of the others, that it might have the floor itself in turn. In fact, however, the methods of the different sciences are much more closely related than their results, and I am much mistaken if I, as a zoologist, shall not learn at least as much from the contributions to scientific method made by the botanists and geologists as from those

in my own field. I may care little for the classification of the Ustilagineæ, but the methods by which that classification were worked out may be of the greatest use to me in entomology. I had occasion at one time to study minutely a purely biological problem—that of the food preferences of certain families of beetles, about which too little was known, but found that I could do nothing with it except by the methods of the insect anatomist, on the one hand, and of the microscopist on the other. I need to know about the contagious diseases of insects, as a matter of practicable and biological entomology, but find myself powerless to investigate them until I become expert in the methods of the baceriologist and the cryptogamist generally, and until I can make the nicest of histological preparations. I would like to learn the life histories of some phytophagous insects, but by the time I have worked them out I shall have made a close practical acquaintance with several of the methods of botany and horticulture. A new piece of apparatus in the hands of the mineralogist will suggest to the botanist a device solving a difficulty which has long blocked his way in some tempting line of investigation. I wish now that some chemist would tell me how to distinguish spherical pigment granules, by chemical means, from micrococci. That item of chemical method would break down a barrier against which I have bumped my head in vain for a year.

And if this is so with methods of research, much more is it true of methods of instruction. The geologist has to do primarily with rocks and fossils, the botanist with plants, and the zoologist with animals; but teachers of whatever subject all have to do primarily and chiefly with the human mind and the training of it, and teachers of whatever natural science have special ends in view with respect to the training of mind not very widely different. If I shall be profited by knowing how the geologist does his work, much more shall I be pleased to learn how he leads his classes; and it is to be hoped that the discussions of teaching methods to which our meetings should give rise will result finally in the common acknowedgment and established use by all of us of certain principles and methods, such that our work may have a uniform character, and its results a definite value, not wholly dependent on the point of view and the personal idiosyncrasy of the instructor.

While our community of interests, this overlapping and intermingling of methods, brings us into closer fellowship than if this were an academy of sciences merely, so the motive that induces us must give our meetings an air of cordiality, of mutual gratitude, and good will. He who reads me a paper embodying results of research—the finished product of his work—may do it for my benefit, or possibly for his own—it sometimes takes evidence to determine which; but he who takes me into his shop, and shows me just how and with what he works, exposes to me the skilled methods which have yielded the results I admire and emulate, does that for *me*, there is no doubt about it.

We may be sure that the contributors to our programmes will be governed by a generous wish to share with each other the most precious items of their knowledge, those on which they especially depend for their own professional success.

Then we shall profit greatly, beyond a doubt, by the knowledge gained of the state and progress of science and education in our midst, as we hold our successive meetings in the various centres of education and research throughout our territory; and thus we shall learn what is the best thing which we as a Society can do for science in this region, and in each part of this region, from year to year, and shall be prepared always to welcome intelligently, and readily to assimilate the new energies penetrating to our midst—avoiding, on the one hand, that attitude of selfish and obstinate conservatism, which, acting on the unprincipled motto, "After us the deluge," would sweep back the future with its burden of progress; and, on the other hand, rapidly, but genially, toning down the crude and intolerant egotism of the occasional brand new man, who thinks to himself, "Before me chaos." And so we shall hold, I hope, to the golden mean of vigorous and rapid, but continuous and harmonious, growth.

But the scientist is also a citizen, and all the more a citizen the more a scientist he is, if he knows his own interest and duty. His social responsibilities, like those of all other men, increase with his capacity, with his possible importance as a factor in the social scheme; and he has a special social interest due to the fact that the higher the grade of his work, the more important to him, the more nearly indispensable, indeed, is a high grade of social organization

about him—a fine and intelligent spirit; for without these, the institutions, the enterprises, essential to his success can neither be established nor maintained. Each scientific society, if it is to live and thrive, must serve as a centre of upheaval for the community at large. If we unite and firmly bind ourselves in a society of restricted numbers, and with somewhat limited conditions of admission, this is not done with any unworthy purpose of discriminating in our own favor, or of confining to our membership the benefits of our association, but to give unity and distinctive character to our influence, that it may reach farther and go deeper than if the energy of our organization were to be chiefly spent in keeping ourselves alive.

And so we may inquire, what is to be our outside influence? I think that we may reasonably expect, acting within the limits of our organization, and along the line of our special purposes, to have a stimulating and directive influence upon the science work of the educational institutions and associations of this region, upon the local scientific societies with which we are connected, and, through our meetings and papers, upon the more intelligent part of the general public. While ours is not primarily an association of teachers, but of original workers in science, it so happens that most of us teach, and there is certainly no way in which we can advance science more effectively than by sending out classes of bright and ambitious pupils prepared for research. Discussions of the methods of this work must consequently always be in order; and besides this internal work and influence, I believe that we should lay down, advocate, and defend a few general principles—bearing, for example, on the relations of instruction and investigation, on the main ends of training in science, on the selection, arrangement, and co-ordination of subjects in each division of the courses in which we are especially interested; on the amount, kind, and time of introduction, of primary work in science preparatory to that of our higher institutions of learning, and the like. Preliminary, however, to any application of such principles to the actual situation in this region, we certainly and especially need to examine the situation itself, with respect to the institutions which we represent, to others not connected with us by membership of their instructors, and to the preparatory and high schools generally. I would greatly like

to see a committee or committees raised which should report to us at our next meeting a well-digested exhibit of these matters. Nothing could be more useful to us, and nothing, I think, would bring our work more directly and favorably to the notice of our immediate public. And then, in the papers and discussions of our school and college associations, in our State and more local scientific societies and academies, we should bring to bear the ideas and principles established by discussion here, and so carry the work outward by concerted action, as by a movement in line.

To our semi-scientific and scientific associates outside this body, we should, of course, carry whatever new thing of applicable value our meetings give us possession of, and thus enlarge the circle of the Society's influence. In these and other ways I hope that we might do much to increase the number of intelligent local observers and earnest independent students—now far too few in this region—and thus help to create and sustain a scientific sentiment, in which the present and approaching generation certainly fall far short of that now going out of action. It is a suicidal blunder to discourage the amateur, to undervalue the mere collector of specimens and reporter of facts, to create the impression, either wilfully or unwittingly, that none but the very learned have anything to do with the promotion of science. We cannot hang the truncated apex of our pyramid to the stars, not even to those of the German heaven—and if we could, we should not, for, after all, science is for man, and not man for science. The general public, it might seem, can scarcely be interested—even the more intelligent part of it—in a conference of specialists respecting their methods of technical work, and yet I think that this view is not altogether correct. Whoever cares for the results of scientific inquiry must usually be curious, at least, concerning the methods by which those often surprising results are reached—and frequently the method is by far the more interesting and the more easily understood. While much of our discussion of details would be tedious, and many fragmentary contributions incomprehensible, we might, I think, at least prepare at each meeting one or more evening programmes for the general public, setting forth fully and systematically several of the more remarkable and interesting processes of the biological laboratory and the geological office; the pure culture of bacteria,

the methods of minute measurement, and those of microphotography, the preparation of serial sections and the like—all to be used, perhaps, as illustrations of the general method of science at large. For, after all, the method of science, if the general public only knew it, is of greater importance to them than its matter. The method of science is simply the *sure* method, and the simplest and most economical consistent with certainty. Any other is either wasteful or unsafe. To know, to appreciate, to command this method, is to control resources beside which the mere knowledge of facts has but little significance.

It will be the most important public function of this Society to extend the knowledge and the use of the method of science, applied in the spirit of science, among the unscientific. The great mission of science is two-fold—to reveal the universe, and to rationalize the human mind. The first of these tasks, vast as it is, is still comparatively easy, for it is wrought out directly by the scientist himself applying the methods and apparatus of research to the facts of nature; but the second is immeasurably more difficult, because it can only be accomplished by a sort of a beneficent contagion affecting the spontaneous activities of the individual mind; by the persuasive influence of example, and a perceived superiority of results. To improve every occasion to expose, to commend, and to illustrate the scientific method, to encourage its application, to lead in its use in the common affairs of life and society—in business, in politics, in ethics, in whatever affects the welfare of man as a social being, is a duty to our kind, the importance of whose performance we shall never perhaps see more eloquently illustrated than by the occurrences of the present moment, when some of the greatest interests of one of the greatest nations of history are hanging on the decision of a purely scientific question by unscientific minds, worked upon by methods as little scientific as one can well imagine.

It thus seems certain, finally, that our young Society cannot languish for want of a field appropriate and peculiar to itself, for lack of a varied, greatly needed, and highly important work, beneficial to its members and to the general community—a work which nothing else is now attempting, and which, if we do not do it, seems likely to remain undone. The quality of our membership, the number and spirit of those in attendance on this, our first

annual meeting, the valuable character of our programme, are all an earnest of growth and active labor. Let us all lend the promising youngster our warmest wishes for a vigorous and useful career, and join in the cheer, long life, and a busy one, to the Western Society of Naturalists.

SKETCHES OF THE CASCADE MOUNTAINS OF OREGON.

BY E. D. COPE.

THE Cascade Mountains of Oregon are destined to be the favorite resort of tourists who love all that is most beautiful, impressive and wild in mountain scenery. Lying over one of the greatest of the fractures of the earth's crust, they represent the remains of successive outflows of molten material at its source. The basis of the range is eruptive, and displays the irregularities of surface due to such origin within comparatively recent geological ages, and to the rapid erosion which naturally occurs in a humid climate. Thus gorges of great depth traverse its masses, and precipices of tremendous height bound many of its elevations. Beautiful lakes nestle in its depressions, and waterfalls leap from level to level on their way to the tributaries of the Columbia. All is clothed in sombre forest of conifers, of larger proportions or more elegant foliage than can be found in any other region. High above all these mountains tower at intervals along the range, the great snow-peaks which give the region its especial beauty. These are extinct volcanoes which raised themselves round vents which long remained open, and which poured out lava, scoriæ, pumice and ashes, after the great fissure was closed.

The great lava outflow from the Cascade Mountain fissure is one of the most extensive the world has ever seen, and was one of the most destructive in its consequences. There were several distinct periods of outflow, two being especially distinguishable in the stratigraphy of central Oregon. Between the outflows from this and from lesser sources to the eastward, a country of eight hundred

miles in east and west extent, and one hundred and fifty miles from north to south, was covered with lava and other ejectamenta, rendering it uninhabitable by animal life. The volcanic materials are found for several hundred miles to the north, at some points continuously with the great tract I have mentioned. The exact connection with the latter remains to be ascertained; but both were deposited at about the same geological period; viz.: from some time in the Eocene to late in the Miocene ages. The area covered is not less than 1,600,000 square miles in extent, embracing all of central and southern Oregon and southern Idaho, and large tracts in Tacoma, Territory. As an offset to this terrible and unexampled desolation of one of the fairest parts of the earth's surface, we have the great snow-peaks standing as silent and imperishable monuments of one of the most tremendous of the wars of the elements that the later earth has experienced.

The grand tour of Oregon is commenced by crossing the gap in the Cascade range at Ashland, just north of the California border, and visiting the Klamath Lake on the eastern side of the watershed. Turning northward, the tourist should visit the Crater Lake, twenty-five miles from Fort Klamath, and return. Then go northward again on the edge of the plateau that overlooks the valley of the Des Chutes River toward the west, from which the highest of the ranges of the Cascades rise, and may be seen in all their magnificence. Continuing on this road, now a stage route, the Dalles of the Columbia river are reached. Thence take the steamer down the river for Portland. The scenery of the long pass of the Columbia through the Cascade Mountains has been often praised, but never too highly. From Portland excellent means of transportation south, up the Willamet valley, will return the traveller to Ashland again, and the grand tour is completed. A trip from Portland to the resorts on the coast-range must not be omitted, for from these can be seen, it is said, twenty of the snow-capped summits of Oregon and Tacoma (Washington), on the one side, and the boundless waters of the Pacific Ocean on the other.

The traveller must make this journey in a private conveyance, if he can do so, excepting as to the Columbia River. He should commence at Sisson's, at Mount Shasta, in northern California. Then he will see the mountains in all their changing moods at his

leisure. He will become personally acquainted with each of the great landmarks as he passes them one by one. First, Shasta of colossal dimensions. Then the perfectly regular Mount Pitt, which overlooks Lake Klamath. Then the Batchelor with blunt apex; next Mount Cope, with its dome and its lower twin summit; and twenty miles to the north, the two peaks of Mount Condon joined at their bases, acute and inaccessible. At a longer interval follows Mount Jefferson, which rears its immense bell-shaped mass from a widely spreading base, to a height of 13,000 feet. Finally, near the Columbia, the perfect cone of Mount Hood lifts its head 14,000 feet and more to the skies. The form of all these peaks is essentially Andean. They are, like Popocatapetl, Cotopaxi, and Pichincha, of a general conical form, and thus quite different from the mountains of the Rocky range, or the Alps, which are mostly culminations of larger masses, or rise from plateaus, so that the visual effect of their elevation above the sea is largely lost. The case is quite different with ranges whose base is, like that of the Cascades, but little elevated above the sea. In the latter nearly the entire elevation is visible. The Cascades also, gathering the moisture from the ocean in a northern latitude, receive and display a greater deposit of snow than ranges of greater elevation in drier or more southern regions. (Plates XX and XXII.)[1]

Although there are many lovely lakes in the Cascade Mountains, none is so remarkable as Crater Lake. This is a body of water which occupies an extinct crater of large size. It is of an oval form and about eight miles by six in diameter. The walls which surround the water rise to a height varying from 900 to 3,000 feet, and they are so precipitous that their descent is practicable at very few points. At the time of my visit (in 1879) but one mode of access to the water was known to my guides. This I descended to the water's edge. It is a very steep washed slope covered with loose stones and scoriæ, among which the descent is much more easy than the ascent. To the south of the centre of the lake is an island which consists principally of a volcanic cone, with a distinct crater in its summit. This represents the latest centre of activity of the volcano. Its sides were covered with tall firs at the time of my visit. The depth of the water is very great. Captain C. E. Dutton, of the present U. S. Geological Survey, informed me that he

[1] The plates referred to will appear in the next number of the Naturalist.

obtained 1,900 feet as the greatest depth, and 1,500 as the average, in 1886. (Plate XXI.)

At the time of my visit Colonel Whipple was in command at Fort Klamath. He carried out a projected visit to Crater Lake at this time and kindly gave me the opportunity to accompany him. As we left the Post we were greeted by the clamor of the beautiful white-headed woodpeckers (*Picus albolarvatus* Cassin) which nested in the tall pines near the officers' quarters. We soon passed seven-mile creek, which abounds in the red-spotted trout of the Pacific coast, or the "dolly-varden" (*Salvelinus malma*), and commenced the ascent. We followed the course of a mountain torrent which often disclosed in its precipitous banks the friable volcanic material of which the mountain is composed. Sand and ashes, with here and there strata of fragments of scoria and lava were principally visible. The soil was evidently good, for it supported a luxuriant forest of trees and undergrowth. Prominent among the former are two beautiful firs, whose foliage is elegant but broadly contrasted in character and appearance. These are the *Abiës nobilis*, and the *A. pattoniana*. The foliage of the former is rigid, and the disposition of the terminal branches almost rectangular. The green is of a rather dark shade. The second species is, on the other hand, feathery in foliage and gracefully drooping in branches, and the green is paler. Above both these species towers the monarch of the north-west, the Douglass fir (*Abiës douglassii*), the largest species of its genus, forming the bulk of the forest. But it yields in height to the occasional sugar pine, *Pinus lambertiana*, with its graceful candelabra-like branches and long cones, the tallest of pines and a fit mate for the Douglass fir.

On our ascent we passed a herd of blacktail deer, which were browsing in security on an open slope of the creek banks. By evening we were encamped on a babbling run under the shade of towering firs. The whisky-jacks, *Perisoreus canadensis*, flitted from branch to branch, and descended to inspect our proceedings with their usual familiarity. Half jay and half titmouse, this bird makes a home of every camp, and tends no little to relieve the sense of savage wildness by its pretty and confiding ways.

By early morning we were at the summit. This was simply an open grassy expanse on the eastern edge of the awful chasm,

surrounded by an irregular border of the forest. The day was clear, and everything could be seen in perfection. Far down on the water I descried a moving white speck, probably a trumpeter swan, as no smaller bird would have been visible at the distance. Across the gulf rose the two points of the mountain called by the hunters the "Rabbit's Ears;" and further to the north-west the aiguille, known as "Cowhorn Peak." The water of the lake glistened in the sun, oblivious to the awful scenes that had once rendered this place the pandemonium of the continent. I descended to the water's edge, and examined carefully for traces of animal life. I found a very young larva of a salamander. More fully grown specimens have been since obtained by Lieutenant Carpenter, U. S. Army, and sent to the National Museum, which are probably the young of *Amblystoma macrodactylum*, the only salamander that has been found adult in that region. Then I found larvæ of Phryganeidæ and Ephemeridæ, and some minute crustacea, as Gammari and water-fleas. Among the rocks on and beside the slope, the "little chief" hare, *Lagomys princeps*, crept in and out, uttering the while its peculiar plaintive cry. It is a rather tame animal, and apparently possessed of much curiosity, but it has always a fissure in the rock at hand into which it retreats if one approaches too near.

The walls of the crater on the eastern side are made up of successive layers of lava, scoria, sand, ashes, pumice, etc., all representing successive eruptions and parts of eruptions. The mass is in places friable, and is penetrated by the waters of the lake at different points, thus giving origin to springs and streams.

At Fort Klamath the soil rests on a deep stratum of pumice. Some of the exposures show this to be broken up and water worn, but at other places it forms a continuous spongy mass. In a stratum of this kind, just below the soil, were cut the four graves of the Modoc Indians, who were hung for the assassination of General Canby, the commissioner sent by the United States to treat with the tribe. These graves were cut out with right angles and borders by the simple use of a sharp spade. At the time of my visit all of them had been rifled, and the bodies taken away. I afterwards obtained the skeleton of one of them. It is characterized by a platycnemic tibia, and tritubercular second and third superior molars.

Soon after this visit I left Fort Klamath for a geological explo-

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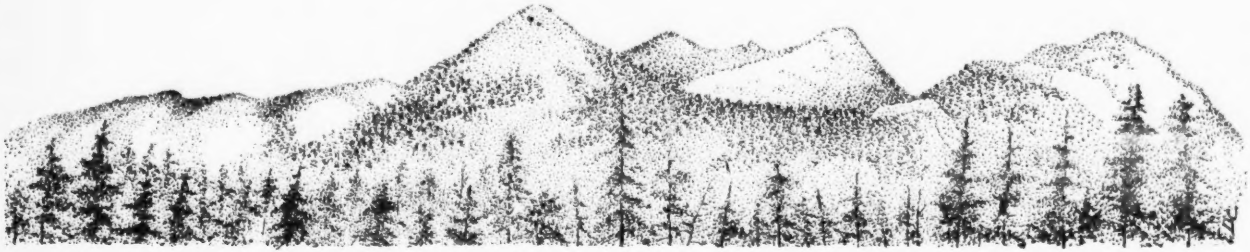

PLATE XIX.—View from Lake Klamath, looking north towards Crater Lake.

ration of the Oregon desert. Of this I may have something to say at another time. I found unexpected assistance in this exploration through Mr. Charles Whittaker, son of the Governor of the State, who kindly placed his time and conveyance at my disposal, and accompanied me to Fossil Lake, and the sandy region beyond. We returned via Silver Lake, and took the main road for the Dalles. This road runs north along the western edge of the sage-brush and the eastern border of the valley of the Des Chutes river. There is nothing to obstruct the view of the Cascade range from this road, and as the greatest elevation of the range is at its eastern border, the view of it from this road is the finest that can be obtained. At a point twenty to twenty-five miles south of Prineville, nearly half the length of the Oregonian portion of the range is included in the panorama, at a least distance of seventy-five miles. From the line of forest-covered mountains rise five magnificent snow-peaks to heights varying from 10,000 to nearly 15,000 feet above sea level. To the north is Hood; then succeeds Jefferson; then Condon, Cope, and the Batchelor. As these mountains do not rise from a plateau as do those of Colorado, the effect they produce is more impressive than that of mountains of greater elevation in the latter region. The wedge of Hood and the cone of Jefferson only find their counterparts in the celebrated volcanoes of the Cordilleras, whose praises have been often celebrated; but nowhere can five Cotopaxis be seen at one view, but in the Cascades of Oregon. They are ideal mountains, grandly simple, whose outlines, rising from base to summit, are only interrupted by vast precipices. They pierce the blue sky with a vertical mile and more of purest white "as no fuller can white," save where the crags are too steep for the snow to cling. When I first saw Mount Hood, nothing but its cone was visible, an island of light, floating in a sea of clouds. When I saw it last, clouds had again separated its summit from the earth, and the rays of the sun gave it an Alpenglühn which resembled the red glow of a furnace, rather than the cold sheen of the ice-peak. Mount Condon is a double mountain, consisting of two peaks with sharp summits, connected by a high saddleback. Its outlines are as steep as those of the others, and it presents an immense surface of snow. Mount Cope is twenty miles south. Its summit is an obtuse cone surrounded by impassible precipices. It is next to Mount

Jefferson in elevation. These mountains are two of the four sometimes called the "Three Sisters." They were given distinct names by the late Dr. Hayden, director of the U. S. Geological Survey of the Territories, but his ill health and death prevented his issuing any publication on the subject. Mount Condon was dedicated to Professor Thomas Condon, of the University of Oregon, a distinguished teacher of geology, and the discoverer of the Miocene beds of the John Day river, of Oregon, which have produced so many remarkable vertebrate fossil remains. The Batchelor has an obtuse apex and resembles somewhat Mount Etna in its outline. A general view of these mountains is given in the accompanying sketches, which I took from two of our camps. One of the last views I gained of the snow-peaks was in the morning as the sun rose. The valley of the Des Chutes was, as before described, filled with white clouds, and these rose to such an elevation as to conceal all but the summits of the volcanic cones. As the sun's rays rested on them they all glowed with such intensity that they could be well compared to masses of red-hot iron suspended in the heavens; and by a stretch of imagination be conceived as once more in their hoary age, ablaze with their internal fires, attempting to revive the terrible glories of the past.

Our road took us away from these sublime scenes of the upper world, to equally extraordinary, if not as gigantic exhibitions of the ancient activity of the volcanoes in the bowels of the earth. We descended into the canyon of the Des Chutes and followed its course for many miles. The descent could not have been less than 2,000 feet, and was accomplished by zigzags and stages innumerable. Prof. Newberry has described this canyon in his report in the series of the U. S. Pacific R. R. Survey volumes. Its walls display a remarkable section of the materials which the eruptive forces cast far and wide, or forced to flow over this afflicted country. High upon the walls of the canyon is a horizontal layer of columnar basalt, the columns vertical. Below this, separated by many feet of a friable deposit, is a stratum of well defined, apparently sedimentary, rock. A deep bed of ash is followed below by another bed of columnar basalt, and this again after an intermediate soft stratum, by a third bed. In the two lower beds the columns are variously disposed. They are frequently curved, forming concentric arcs,

disposed in various directions according to locality. Sometimes the columns are horizontal, resembling piled cord-wood, and all are generally regular and more or less artificial looking.

From this extraordinary gorge we finally issued on a rolling country well covered with bunch-grass, which continued to our destination, the Dalles, on the Columbia river.

EDITORS' TABLE.

EDITORS: E. D. COPE AND J. S. KINGSLEY.

In the annual address of the President of the Biological Society of Washington, Mr. G. Brown Goode, Assistant Secretary of the Smithsonian Institution, uses the following language:[1] "I think the general tendency of a careful study of the distribution of scientific men and institutions, is to show that the people of the United States, except in so far as they sanction by their approval the work of scientific departments of the Government, and the institutions established by private munificence, have little reason to be proud of the national attitude towards science." This indictment is brought after a careful survey of the ground by a naturalist of undoubted competency, and of exceptional opportunities for acquiring information. We are compelled to agree with Secretary Goode, and can, we think, point out some of the conditions of this state of affairs.

Our complaint is that the average American citizen does not know what original scientific research is, and that if he acquires wealth, and wishes to do something for the benefit of his fellowmen, as he does more frequently than the citizen of any other country, he does not do anything for the *production* of knowledge. He devotes money to schools and to libraries, but towards the creation of the books to be used in them, and the truths to be taught in them, he does nothing. Forgetting the lessons of his business training, he apparently imagines that knowledge is derived from some mysterious internal process of the mind, and that the producer

[1] 1887, pp. 92-3.

needs neither material nor apparatus. He supposes that he can make money and scientific discoveries at the same time, and so does not need food, clothing, nor shelter. Or if these essentials be provided, he exacts such an amount of teaching from the unfortunate recipient, that scientific production is suppressed at its fountain-head. Yet these good people like to talk about the scientific progress of the age, and of the benefits that it confers on mankind. Of course most of this comes from an ignorance of what great fields of knowledge remain yet unexplored, and an incapacity to understand what a change will be wrought in our thoughts and acts by the acquisition of that knowledge. The solution of the great mystery of the relations of mind to matter has no interest for them; or, if it has, carries with it no impress of utility. Perhaps some people of little faith fear the results of such knowledge, not reflecting that it is better to traverse the paths of life and death with one's eyes open, rather than with them shut.

The actual state of original research in America justifies the language of Secretary Goode. The number of positions available for the original investigator in the country is small, and many of these are occupied by incompetent persons who add little or nothing to scientific knowledge. Our so-called "Academies of Science"[1] have become lyceums, where little beyond popular display and instruction is attempted. It is true that most of these societies publish "Proceedings," etc., but whence the material to fill these publications with worthy matter is to come, they do not concern themselves. The perversion of these societies from their true object is inevitable, so long as they are compelled to elect members for financial reasons.

After Academies of Science come the Universities. Here the same spirit presents the same obstacles to research. But little time is granted the professors in most of them, and in one case the position has been distinctly announced, that original research does the University no good. The philistinism is here fairly expressed, and the issue is made. Continental Europe is, however, against this modern barbarism, and progress can still find congenial climes. Germany still turns out her volumes rich with observation and thought, on a financial basis so small as to furnish little more than buttons and kid gloves for a fashionable American family.

[1] Except the U. S. National Academy.

But Americans are not Germans, replies a gentleman "of the old school". If so, what is the difference? We have the financial ability, and there is no deficiency of mind in certain classes in the United States. One answer is, that there is a dissociation of the mind and the money. Occasionally an attempt is made to effect a combination. Sometimes the method is grotesque; as when a wealthy merchant recently offered a University the sum of $200,000, to put his son through a four years' course, and make him a professor afterwards. Sometimes the attempt is successful, as in the case of the Allis Laboratory of Milwaukee. We can only say may there be many Allises in the future of our history, and may they be as judicious in their selection of workmen.

We suspect, however, that this state of affairs will not last. The Universities are doing their good work of educating the people, and from these will spring, from time to time, men who understand the growth of the human mind, and how to aid it.

RECENT LITERATURE.

WINCHELL'S GEOLOGICAL STUDIES.[1]—In this work we have an aid to the study of Geology in its various departments, which will have a distinct influence in advancing the knowledge of the science. The student, whether in the school-room or in the field, will find its utility undoubted, whether the clearness of the descriptions or the excellence of the illustrations be taken into account. The long experience of the distinguished author, both in original research, and in teaching, qualify him especially for the production of a work like the present. The departments of stratigraphic and dynamic geology may be specified as the best, as they are the most extended divisions of the book. We cannot speak as highly of the palæontological part. The list of the "most important types of animals and plants," beginning on page 305, is mostly constructed either after antiquated models, or else after false lights of modern character. The Vertebrata are especially bad, and the nomenclature adopted is mostly one which the student will have to forget, if he or she be so unfortunate as to have remembered it. With this defect remedied in future editions we can heartily recommend the work for general use.

[1] Geological Studies or Elements of Geology for High Schools, Normal and other Schools; with 367 illustrations. By Alexander Winchell, LL.D. Second edition. Chicago: S. C. Griggs & Co. 8vo. pp. 513.

JORDAN'S MANUAL OF THE VERTEBRATES.[1]—In this, the latest edition of this well-known work, Dr. Jordan has completely revised the text, turning it end for end, condensing and rewriting almost every page, as well as increasing its scope by admitting to its pages the littoral forms of the Atlantic Coast of the United States. The work is apparently fairly well done both by author and manufacturer, though we might criticise the classification adopted in some cases, or pick out here and there errors of anatomical statement, for Dr. Jordan is confessedly no anatomist, but takes his structural knowledge at second hand. Books of this kind constitute the most popular and useful introductions to the sciences of which they treat, but it must be remembered that they constitute introductions only.

The fault lies not in the keys but in the use to which they are put. They serve the poor teacher, and enable him to do the poorest kind of work with the least possible expenditure of brain force. All he has to do is to give the student a bird or a fish and one of these manuals and the work is done. The poor student, imagining that he is deriving mental discipline by the operation, but not clearly realising where it comes in, struggles with the inoffensive fish or fowl down through pages of "keys," until at last he captures a Latin name which seems to fit it. As has been wittily said, "it is like tracking a woodchuck to a hole, when you get there all you have is a hole." Yet this process is daily going on in hundreds of our high-schools and scores of our colleges to-day. In many an institution which rejoices under the name of University the biological students never learn a single anatomical fact, never hear a single embryological statement; their whole knowledge of the varied forms of life around them consists in having learned the names of a few dozen vertebrates and flowering plants. While the botanical manuals of Wood and Gray are largely responsible for the wide taste for botany in the United States, they are too often regarded as the *summum bonum* of the science by the teacher. True zoologists must be on the alert or similar works upon the animal side will be used in the same superficial way.

[1] Jordan, David Starr. A manual of the Vertebrate Animals of the Northern United States, including the district north and east of the Ozark Mountains, south of the Laurentian Hills, north of the southern boundary of Virginia, and east of the Missouri River. Inclusive of Marine species. Fifth edition. Chicago, 1888. Pp. 375.

RECENT BOOKS AND PAMPHLETS.

Studies from the Morphological Laboratory of the University of Cambridge. Vol. III. Part 2. From the Balfour Library.

Behrends, Gerhard J.—Beiträge zur Kenntniss der Entwickelung des Nervus opticus und des Glaskörpers bei Säugethieren. Erlangen, 1888. From the author.

De Man, J. G.—Crustacea of the Mergui Archipelago. Part III. Ext. Jour. Linn. Socy. Vol. XXII. 1888. From the author.

Heathcote, F. G.—The Post-embryonic Development of Julus terrestris. Ext. Phil. Trans. 1888. From the author.

Edwards C. L.—Winter Roosting Colonies of Crows. Am. Jour. Psychology. 1888. From the author.

Mitsukuri, K., and Ishikawa, C.—On the Formation of the Germinal Layers in the Chelonia. Ext. Q. J. M. S. XXVII. 1886. From the authors.

Weismann, A., and Ishikawa, C.—Ueber Partielle Befrüchtung. Ext. Bericht Naturf. Gesellsch. Freiburg. 1888. From the authors.

Beddard, F. E.—On Certain Points in the Visceral Anatomy of the Lacertilia, particularly of Monitor. Ext. Proc. Zool. Soc. London, 1888.—Visceral Anatomy of Balæniceps rex; The respiratory organs in certain diving birds. Ext. Proc. Zool. Soc. London, 1888. Both from the author.

Shufeldt, R. W.—Observations on the Morphology of Gallus bankiva. Ext. Jour. Comp. Surg. and Med. 1888. From the author.

Goode, G. B.—The Beginnings of American Science in the Third Century. Ext. Proc. Biol. Socy. Washington, 1888. From the author.

Fewkes, J. W.—On the origin of the present form of the Bermudas. Ext. Proc. Bost. Socy. 1888.—A new marine Larva and its affinities. Ext. The Microscope. 1888. Both from the author.

Hargitt, C. W.—Recent Notes on Scaphiopus holbrookii. From the author.

Shufeldt, R. W.—The Osteology of Habia melanocephala, with comparative notes on the skeletons of certain other Conirostral birds and of Tanagers. Ext. Auk. Vol. V. From the author.

GENERAL NOTES.

GEOGRAPHY AND TRAVEL.[1]

GENERAL.—THE VOYAGES AND FATE OF LA PEROUSE.—Apropos of the centenary of the death of La Perouse, the *Bulletin of the Geographical Society of France* gives a summary of the voyages of that unfortunate navigator. The *Boussole* and the *Astrolabe*, under his command, left Brest August 1, 1785, doubled Cape Horn on February 8 of the next year, reached the Sandwich Islands in May, made the coast of America near Mount St. Elias on June 23, followed it to Monterey, and thence crossed the Pacific to Macao. On April 9, 1787, the expedition started again to reconnoitre the Japanese Isles and the coast of Tartary. The island of Dagelet was discovered May 27; the strait of La Perouse, between Saghalien and Jesso, soon after; and on December 9 the vessels anchored at Mauna, one of the Navigator group. Here M. de Langle, the commander of the *Boussole*, together with the naturalist Lamanon and ten men, were surrounded by the natives and killed. The last letter that reached France from La Perouse was dated February 7, 1788. The story of the discovery of the remains of the expedition at Vanikoro, in the Fiji, is told by Vice Admiral Paris, the last survivor of the expedition sent out in 1826 under the orders of Dumont d'Urville. The *Astrolabe*, commanded by this captain, was only a small transport bearing the name of a corvette. At Vanikoro information was obtained that five bronze cannon and some skulls of Europeans were in possession of the natives, and also that a vessel had been wrecked there and its crew massacred. The débris of the frigate *Astrolabe* was finally found opposite the village of Paiou. A monument to the memory of La Perouse was raised upon the islet of Manevai.

ASIA.—THE ETHNOGRAPHY OF HINDUSTAN.—F. v Hellwald (*Ausland*, Nos. 31–35) has an article upon the ethnography of Hindustan. The 252,000,000 of inhabitants belong to four races, black, yellow, Turanian, and Aryan. The primitive population consisted of two types, one Malay, still to be found in the south and on the Malabar coast; the other Semitic, still existing in the Nilghirries and in the north of India. This primitive population was driven back by Turanians descending the Brahmaputra valley, and these invasions precede the historical period. The mixture of these Turanians with the indigenes gave rise to the Protodravidas,

[1] Edited by W. N. Lockington, Philadelphia, Pa.

and from the mingling of the latter with the Mongols arose the Dravidas or Tamals. The defiles of Afghanistan first let in the Turks, who spread over the Indus valleys, and afterwards the Aryans, who extended their rule to the Vindya Mountains, and further south became mingled with the older peoples, forming the Bheel, Dhang, and other tribes. In the eleventh century the various Mussulman peoples added to the ethnographical confusion.

THE AMUR VALLEY.—M. Venukoff contributes to the September number of the *Revue de Géographie* an account of the region of the Amur, which he characterizes as fit for colonization. The vast country watered by the Amur and its affluents, the Zeya, Bureya, Tunguska, etc., flowing from the Stanovoy mountains, consists of fertile plains and rolling or rugged surfaces in about equal proportions. The fertile part comprises an area equal to a third of that of France. This plain country consists chiefly of five separate portions, two of which, that in the basin of Lake Evoron and that upon the lower Amur, have a fresh and humid climate, while the other three, higher up the Amur, and reaching to the base of the Touine, Wanda, and Little Khingan mountains, offer all that is necessary for the existence of European agriculturists. The population of these plains does not at present exceed 85,000 Russians, Chinese, Coreans, and Tungusians all told.

AFRICA.—THE FRENCH IN SENEGAMBIA.—The progress of French rule in the Senegambian region since 1881 has been very considerable. At that date Colonel Borgnis Desbordes left St. Louis, imposed contributions on several rebellious chiefs and entered Kita early in 1882. Though he had only 220 fighting men and could expect no help from the timid indigenes, he entered into a campaign against Samory. The latter was defeated, and the town of Keniéra fell into the hands of the French. Those who doubt the propriety of European interference in Africa, would do well to read M. Pietri's description of the sight which met the conquerors on entering the town. "In the plains around the village were corpses and their detached heads; a little farther rose heaps of cinders yet burning and mingled with the blackened bones of the prophet's victims, and the wells of the village were also full of corpses. * * * * * * Our soldiers found some unfortunates still alive, suffering from ugly wounds, the executioners not having had time to finish them. Even these horrors were less harrowing than the sight of the families of the victims, naked, fleshless, living statues of hunger who stretched out their arms to our soldiers praying for food." In 1882 the same Colonel attacked and took Murgala and Daba, thus breaking the power of the Toucouleurs and also of the Bambaras, who bravely defended the latter town. Bamaku, on

the Niger, was reached early in 1883, but a league was formed against the French, and the Spahis, spite of their bravery and the great loss of the enemy, were compelled to retreat, only again to advance and gain victory after victory, thus assuring the domination of the Upper Niger and the rule of a country equal to a third of France.

The French in Senegambia soon encountered a new enemy in the person of Mahmadu Lamine, a Mussulman of Kayes, who resolved to found a new empire in the Sudan by playing the rôle of prophet. In 1886 the marabout had fifteen to twenty thousand men grouped around Kayes, yet by the end of the year his power was broken. A treaty was made with Samory in 1887. He accepted the Tankisso as the limits of his state and placed his country under French protection.

M. Vigué (*Rev. Sci.*, Oct. 27, 1888) contributes an interesting article on the tribes of Senegambia. Notwithstanding the chaos of tribes the author believes that all the indigenous peoples may be referred to two stocks; one of them the Guinean proper, the other comprising the Mandingoes, Fulahs, and tribes formed by the intermingling of these two. The numerous foreign Sudanese, Walofs, Toucouleurs, etc., are not comprised in either of these categories. The peoples of the coast of Senegambia, all of them miserable fetichists, appear to be of the same stock with the more powerful tribes found further south, such as the Ashantis and nations of the Lower Niger. These Guinean tribes have been pushed back by the invading Mandingos and Fulahs, until only a narrow strip on the coast was left to them, and would without doubt have disappeared altogether had it not been for the advent of Europeans.

AMERICA.—M. THOUAR'S CONCLUSIONS.—The last expedition of M. Thouar in the region of the Chaco led him across a waterless desert and the sufferings of the party were very great. Several men deserted, and out of twenty-one men only three returned alive. In his report presented to the Bolivian Government, M. Thouar came to the following conclusions: (1) That the northern part of the Chaco is entirely arid and waterless, (2) that the opening of a wagon road across this region is impracticable, (3) that a railroad from Sucre to Pacheco would not pay, but (4) that the opening of the Pilcomayo needs only some simple works of canalization, which would be largely compensated by the profits drawn from the auriferous sands and fertile lands of its coast.

EUROPE.—THE FAROËS.—The Faroë Islands are twenty-six in number, and have a total area of 1,333 square kilometres. Seventeen only are inhabited. Almost all are elongated in a north-

west and southeast direction; this is also the direction of the fjords that intersect them. Stromö and Osterö, the two largest, have summits of 800 and 970 metres, and a mean altitude of 300 metres; they are cut up by deep valleys which are continuations of the fjords. All the islands are elevated and surrounded by cliffs. The group is composed of beds of basalt, mingled with carboniferous strata. The volcanoes which produced the basalt must have been well to the west of the archipelago. The islands have a very humid climate; Torshavn receives two metres of rain annually, spread over 267 days of the year.

The Faroë Islands were colonized in the ninth century. Christopher Columbus visited them in 1467. The inhabitants retain some traits of the old Vikings; they are tall and strong, with blonde hair and red beards. The women do not cover the head. The sheep is to the inhabitants of the Faroës what the reindeer is to the Laplanders, and its flesh, with the produce of the fisheries and the eggs of sea birds, constitute the main food of the islanders. Thorshavn is the political centre, but its harbor is obstructed by ice in the winter. Another important port is Kirdeböe.

The Oscillations of the Swedish Coast.—M. L. Holmstrom (*Revue Scientifique*, Sep. 8) brings together the varied observations of Celsius, Runeberg, Gissler, Nordenanckar, Hällström, Wikström, Lyell, Erdmann, Bruzelius, Forssman, Börtzell, and others, relative to the changes of level in the coast of Sweden. There is full proof of a lowering of the sea level on the western coast of Sweden during the last forty years. Marks cut in the rock show the levelings in 1847, 1867, and 1870, and the present level of the seaweed indicates an annual sinking of 0^m, 40. M. Holmstrom states that he knows no fact tending to show that the Norwegian coasts are now changing level, but those of Finland seem to vary in an analogous manner to those of Sweden. M. Holmstrom does not consider that the lowering of the sea level is by itself a proof of the rising of the land, since it is now well known that the ocean service is not exactly spheroidal, but is elevated by the attraction of elevated continental masses.

So long as the relative masses of the continents remain the same no alteration can take place in the mean sea-level, but augmentation or diminution of the land masses cause a rising or falling of the sea-level.

Geographical News.—Europe.—The mortality of Madrid during the last ten months has been forty-five per 1,000 and that of the last eight years has been 41.7. Epidemics of small-pox and diphtheria, caused by the defective sanitation of the city, largely account for this high mortality.

According to statistics brought together by M. Turquan, an average number of seventy-eight centenarians, twenty-seven men, and forty-six women, die annually in France. This average is based on 1,474 observations. The northern slope of the Pyrenees seems to be a favored region for longevity, since 38.8 per 100,000 in the Hautes Pyrénées and 38.4 in the Basses Pyrénées attain 100 years. The percentage diminishes northwards, but increases somewhat in the basin of the Seine.

The *Bulletin of the Alpine Club* states that immense caverns containing a subterranean lake and water-courses which seem to be connected with the river Yonte, have been discovered by M. Fabié in the Casse Mejean, an isolated mountain 900 to 1,300 metres in height.

ASIA.—Disguised as a Mussulman, Dr. Hurgronji, of Leyden, has resided six months at Mecca. The city has not sensibly changed since it was visited by Burkhardt, in the beginning of the century. This traveller denies that the black stone of the Kaaba is a meteorite, since a similar stone occurs in the sacred mountain of Abu Gübez.

AFRICA.—By the protectorate over Bechuanaland and the country of the Makalekas and Machonas, recently assumed by Great Britain, the Boer republics are entirely surrounded by British possessions, except where they touch Portuguese territory on the east. Zululand has also been declared British territory, but will form a distinct colony from Natal.

The old State of Harar, once governed by an independent emir, and afterwards annexed to Egypt, has, since March, 1887, been in the possession of Menelik, king of Shoa.

England took possession of the island of Socotra on November 30, 1886.

The English have abandoned their claims to the southern coast of the Bay of Tadjura, in the gulf of Aden, and a considerable portion of the western shore of that gulf is now under the protection of France.

As the Baptist Mission of Victoria was within the bounds of the Cameron country, which by the Anglo-German convention of 1885 belonged to Germany, it has been given up, and is now occupied by missionaries from Basle.

Great advances have been made in the knowledge of the geography of Madagascar since the treaty concluded between the French and the Hovas, in December, 1887.

The new republic founded by the Boers, on the frontiers of the Transvaal and of Natal, in the territory of the Amazulu, is now annexed to the Transvaal repuplic.

The atlas of Morocco, by M. de Foucauld, is a most valuable addition to the geography of the north of Africa. The lines of mountains and rivers shown on previous maps are here considerably modified. The Atlas range in Morocco is composed of three parallel chains instead of one, and the course of the Dra is found to be in its upper part half a degree to the west of its previously supposed position.

Captain Pleigmeur, who was commissioned to study the levels across the French African territory, between the Atlantic Ocean and Stanley Pool, was drowned in the River Niari.

The Northwestern African Trading Company, which succeeded to the rights of Mr. Mackenzie at Cape Juby, near the frontier of Morocco and opposite to the Canary Islands, imposes a duty of from ten to twenty per cent. upon merchandise going into Morocco. The factory of this company was recently attacked by the natives, and the director, M. Morris, was assassinated.

In May, 1888, news was received from Cairo respecting Lupton, Slatin, and the other prisoners of the Mahdi. Their situation is the most miserable possible, they are condemned to the hardest and most humiliating tasks. To negotiate for their release would be trouble lost, to organize an expedition would be to hasten their death. None the less it is a shame to leave Europeans in this deplorable condition.

GEOLOGY AND PALÆONTOLOGY.

Description of New Species of Fossils from the Rockford Shales of Iowa.—Professor Newberry, in speaking of the mingling of the Devonian fauna of Ohio,[1] says: "The mingling of the fauna of the Hamilton and Corniferous is apparently somewhat greater here than in New York, but this is readily explained by the fact that here, as in other portions of the Western States (Iowa included), there were no such striking alternations of conditions during the successive deposition of strata as are indicated at the east.

"An open sea prevailed throughout several successive periods at the west, and during these an unbroken series of limestone strata was formed, while at the east alternating shore and off-shore conditions interposed sheets of mechanical sediment, and gave more distinctness to the fauna of each formation."

[1] Geology of Ohio, Vol. I., p. 144.

Now, however applicable these statements may be to the Devonian rocks of other States, they certainly are not, to any such degree, applicable to the rocks of this age in Iowa. The Devonian rocks of this State, as observed by Dr. White,[1] are serially isolated.

The occurrence of extensive beds of very coarse and fine-grained sandstone, varying from five feet to forty feet in thickness (sometimes obliquely and discordently stratified throughout), and blue and buff shales, some of which are extensively sun-cracked, and others containing abundant remains of land plants, as well as extensive beds of blue clay and hard, fine-grained and compact limestone, and the varying fauna of the several divisions, all attest that there were nearly equally as striking alternation of conditions during the successive deposition of strata in Iowa as are indicated "at the east;" and that the alternating shore and off-shore conditions which interposed sheets of chemical and mechanical sediment, have, to a greater or less degree, given a distinctness to the fauna of the several divisions equal to that "of the east."

An interesting and instructive feature of the exceedingly rich fauna of the Rockford Shales of Iowa is the extreme minuteness of a considerable number of its fossil species. Of these minutissimic, yet adult, forms, more than fifteen are Gastropoda, four Brachiopoda, three Crustaceans, four or five Foraminifers (suborder Perforata), and five or six small Bryozoan corals. These forms, which comprise slightly over one-seventh of all those known to occur in this formation, are usually well represented both as to genera, species and individuals.

The organic life of the old Devonian sea in Iowa culminated in these shales; and at this time was ushered in a period when the conditions were much more favorable to the existence of life than at any other epoch of the Devonian age in this State. Immediately underlying the Rockford Shales is a stratum of dark blue clay from twenty feet to twenty-five feet in thickness, and entirely destitute of organic remains; this attesting conditions, when the material was laid down, extremely unfavorable to the existence of any form of life. Upon the ushering in of conditions under which the material of the super-incumbent shales was deposited, the change from the pre-existing conditions was very abrupt.[2]

Although the change in the character of deposition here was very sudden, yet the change as to congeniality to life seems not to have been so rapid, as appears to be attested by the fact that nearly all the depauperate forms above enumerated occur at the *base* of these shales.

[1] White's Geology of Iowa, 1870.

[2] There are nowhere beds of passage from the blue clay below to the shales above, the change having been everywhere very rapid and sharply defined.

But that conditions eminently favorable to the existence of life finally took place, is demonstrated by the fact that from a few feet above the base of the formation to the top of it, the strata is crowded to repletion with various normal, and often large, forms of life.

As will be observed by the enumeration, Brachiopods form but an inconspicuous feature of the fauna at the base of the shales; while the fauna of the higher horizons of this formation shows a preponderance, both as to numbers of species and individuals, of this class of organic remains.

In general, the different classes of fossil remains, as Brachiopoda, Gastropoda, Crustaceans, etc., are restricted in their vertical range to certain definite horizons, and so do not occur in equal force throughout the entire formation.

This paper, together with others published and in press, are preliminary to a Monograph on the Devonian formation of Iowa.

Rhynchonella subacuminata, n. sp.—Shell somewhat variable; sub-triangular in marginal outline; greatest width above the centre of the shell; contracting quite rapidly to the front, where it terminates in three sharp angles, which are produced by the sharply angular folds on the front of the valves. Dorsal valve strongly convex in the centre; furnished with three prominent sharply angular folds at the front, which usually become obsolete before reaching the centre of the shell; sinus, large, deep, and broadly rounded; margined in front by from two to three sharp, short folds; front and cardinal margins sharply serrate. Surface of shell smooth; texture fibrous. In the young specimens of this species, folds or elevations are not present on any portion of the shell.

Position and locality: Rockford Shales, Hackberry, Cerro Gordo county, Iowa.

Athyris minutissima, n. sp.—Shell minute; subovate in outline; valves strongly and nearly evenly convex; greatest convexity above the middle; cardinal margins sloping rapidly to slightly below the centre, thence rather broadly curving to the front. Ventral valve slightly more convex than the dorsal valve; umbo prominent; beak sharp, and incurved over the beak of the opposite valve. Dorsal valve slightly less convex than the opposite valve; umbonal region strongly convex. Surface marked by strong equi-distant imbricating lines. Neither valve has an elevation or depression at the front that would correspond to a mesial fold or sinus.

Dimensions: length, $2\frac{3}{4}$ mm.; greatest width, 2 mm.

Position and locality: lower portion of Rockford Shales, Rockford, Floyd county, Iowa.

Paracyclas validalinea, n. sp.—Shell rather large, oblong, sub-circular in marginal outline; length and breadth usually unequal; dorsolateral portion of the shell strongly produced. Valves ventricose; most strongly so at or slightly above the centre; cardinal line strongly arcuate; beaks prominent and strongly curving forward, distant, situated centrally or very nearly so. Muscle impressions large, and in well preserved specimens distinctly marked; the posterior one sub-circular; the anterior one obliquely subreniform, and considerably smaller than the posterior one. Pallial line prominent, parallel to which is a prominent row of pustules arranged side by side. Surface unknown.

This shell differs from any form previously described that is known to me. This form is known only by its cast, of which over one hundred specimens have been secured.

Position and locality: Rockford Shales, Rockford, Hackberry, and Owens' Grove, Iowa.

Platystoma mirus, n. sp.—Shell very minute; suborbicular in outline; spire nearly on a plane with the body whorl; volutions about three. Outer volution large, strongly convex, rounded; suture not very distinct; aperture sub-circular; outer lip of moderate thickness with entire margin; columella lip not distinctly produced; umbilicus closed. Surface smooth.

Dimensions: diameter, 1 mm.; height, $\frac{3}{5}$ mm.

Position and locality: lower portion of Rockford Shales, Hackberry, Iowa.

Platystoma pervetus, n. sp.—Shell semi-circular to subovate in outline; spire elevated but little above the body whorl; volutions about three; the body volution very large, rounded, and very convex; suture well defined; aperture sub-circular; umbilicus deep. Surface smooth.

Dimensions: greatest diameter, $\frac{3}{4}$ mm. to 1 mm.; vertical height, $\frac{3}{4}$ mm. to $\frac{1}{2}$ mm.

Position and locality: lower part of Rockford Shales, Hackberry, Iowa.

Naticopsis rarus, n. sp.—Shell somewhat subovate in general outline; spire slightly prominent, depressed; volutions three; convex, rounded; increasing rather rapidly in size from the apex; body whorl large, forming by far the greater bulk of the entire shell; broadly rounded on the sides. Suture distinct; aperture subovate; outer lip thick; inner lip not defined. Surface smooth.

Dimensions: height, $1\frac{1}{2}$ mm.; greatest breadth, $1\frac{1}{5}$ mm.

Position and locality: base of Rockford Shales, Hackberry, Iowa.

Turbo strigillata, n. sp.—Shell turbiniform, thick; spire depressed, conical; whorls four, increasing rapidly in size from the apex; those of the spire convex, but not distinctly rounded; last

one large, strongly inflated; lower portion rounded; upper surface somewhat flattened, and marked by a distinct revolving groove or depression, which becomes obsolete on the second volution, or almost before reaching it. Suture from nearly linear at the apex, to comparatively deeply channeled below; aperture orbicular; outer lip thick, entire; columella lip very thick, especially the lower portion. Surface of body volution ornamented by strong sub-equidistant, oblique, sinuous lines.

Dimensions: vertical height, 2 mm.; greatest width, 2 mm.

Position and locality: base of Rockford Shales, Hackberry, Iowa.

Turbo (?) incertus, n. sp.—Shell conical, turbiniform, comparatively thick; volutions four, moderately increasing in size; the upper ones convex, but little rounded; the last one large, and somewhat more rounded than the upper ones; the second whorl has also a slightly more curved outline than the two upper ones; suture well defined; aperture imperfect, but apparently discoid. Surface marked by simple straight lines.

Dimensions: vertical height, $2\frac{3}{4}$ mm.; diameter at base, $1\frac{3}{4}$ mm.

Position and locality: base of Rockford Shales, Hackberry, Iowa.

Holopea tenuicarinata, n. sp.—Shell thick, small, sub-coniform; spire rather rapidly tapering; volutions four, convex, flattened above; the body whorl ventricose, rounded, nearly or quite equal in height to all of the others; slightly produced in front. Exact form of the aperture unknown, but judging from the portion which remains unbroken, it was subovate in outline; the portion of the outer lip which remains is thick. Suture sublinear above, and slightly channeled below. Surface ornamented by rather obscure, oblique, curved lines.

Dimensions: height, 2 mm.; greatest width, 1 mm.

Position and locality: base of Rockford Shales, Hackberry, Iowa.

Cyclonema brevilineata, n. sp.—Shell turbonate; rather thin; spire strongly depressed, conical; volutions three, increasing quite rapidly in size; those of the spire convex, rounded; last one large, somewhat more broadly rounded than the upper ones; upper surface very slightly flattened; suture well defined below, but not so distinctly defined above. Aperture ovate to sub-circular. Surface of body whorl marked by strong revolving lines or ridges, which become obsolete (except in the case of one specimen) on the second volution; interstices about equal to the width of the revolving ridges; surface of the upper volutions smooth. The revolving lines on the first turn show, under a strong magnifier, a more or less strong crenate character, though not caused by lines of growth.

Dimensions: greatest width, $1\frac{1}{2}$ mm.; vertical height, 1 mm.

We have in our cabinet many specimens of this species, all of the same form and size, and showing (with the single exception noted) the same surface marking.

Position and locality: base of Rockford Shales, Rockford and Hackberry, Iowa.

Cyclonema subcrenulata, n. sp.—Shell small, sub-turbonate; spire depressed, sub-conical; volutions three, increasing rapidly in size from the apex; those of the spire slightly convex, flattened; last one large, equal to two-thirds the bulk of the entire shell, convex, flattened, or very broadly rounded; rounded at the periphery; suture well defined; aperture oblong-ovate. Surface ornamented by strong, sharply elevated, revolving ridges, which are distinctly crenated by the strong, slightly oblique lines of growth.

Of these revolving lines, fifteen may be counted on the body volution in close proximity to the periphery, three of which are very minute, and implanted between the main ridges; these are rather short, as well as one of the main ones which joins the suture.

On the upper portion of the body whorl, between the suture and the first revolving line, is a flattened or slightly concave space, which is marked by stronger and more oblique striæ than other portions of the surface of the shell; on the whorl next above the body volution, four revolving lines may be counted.

This species seems to be somewhat closely related to *C. crenulata* of Meek (*Geological Survey of Ohio, Palæontology*, Vol. I., p. 213, Plate XIX., Fig. 2, a, d), but differs from it in its more strongly depressed form, less number of volutions, and slightly different form of the aperture; it also has a less number of revolving lines (three of which are minute and implanted), and a more profound crenate character, as well as the distinct belt or flattened area occupying the upper part of the first volution.

Dimensions: height, 11½ mm.; greatest width, 11½ mm.

Position and locality: lower portion of Rockford Shales, Rockford, Iowa.—*Clement L. Webster.*

HANDBUCH DER PALÆONTOLOGIE OF ZITTEL.[1]—We welcome another installment of this excellent work, which carries the subject to the end of the Batrachia from the Actinopterygia, mostly inclusive. We have already indicated our dissent from the classification of the fishes adopted, but the very full references to the literature of the subject in this work furnish the alternatives to the student We notice some typographical errors (as Ganorhynchus for Gonorhynchus, and Scyllæmus for Syllæmus), and a few errors of nomenclature of no great importance. An error once started, often has a strong vitality, as in the case of the name Daptinus Cope, which I

[1] Unter Mitwirkung von Dr. A. Schenk. Palæozoölogie; III Bd., 25 lieferung; 154 Holzschnitten. Teleostei (finis) et Batrachia.

long since showed is the Saurodon of Hays, of much prior date; and Protosphyræna Leidy, which, if it be used at all, belongs to the species *P. striata*, and not to the genus Erisichthe Cope. The name Saurodontidæ Cope should not be replaced by Saurocephalidæ of later origin, because Saurodontidæ Zittel, of later date than either, has been applied to another family, which should, if well defined, have another name.

In the Batrachia, Professor Zittel divides the Stegocephali into three primary groups, the Lepospondyli, Temnospondyli, and Stereospondyli. In the first the vertebral centra consist of a simple sheath round the chorda dorsalis; in the second the centra are segmented; and in the third they are amphicœlous and "completely ossified." The author does not adopt the divisions Ganocephala, Rhachitomi, and Embolomeri. There are serious objections to the system proposed by Prof. Zittel, which I will state. There does not seem to be any real difference between the Lepospondyli and the Stereospondyli, since a tubular vertebral centrum passes by the most insensible gradations into an amphicœlous one. The Temnospondyli cannot be regarded as homogeneous, or exactly defined. In fact, the vertebral centra of the Embolomera are not segmented, but are as entire as in the other two divisions of Zittel. The presence or absence of two occipital condyles is also a character not to be neglected in this connection.

The account of the Stegocephali (including Ganocephala, Rhachitomi, and Embolomeri) is the most complete ever placed in the hands of students; in fact it is the *only* synopsis yet published. In the midst of this important monograph we are compelled to make two corrections. The lettering of the pelvis of Eryops (p. 364) is reversed in position. Secondly, the genus Stereorhachis Gaudry (p. 398) is not a Bratachian, but a reptile of the order Theromora, and probably of the family Clepsydropidæ.—*E. D. Cope.*

Schlosser on Carnivora.[1]—The second part of Dr. Schlosser's important memoir includes the lower Carnivora, or the Ursidæ, Canidæ, and Mustelidæ. It includes much that is new on the subject, and by its thoroughness and critical character advances our knowledge of the European forms much beyond any previous publication. A number of new genera are added, as Pachycynodon in Canidæ; Pseudamphicyon in Ursidæ; and in Mustelidæ, Plesiocyon, Haplogale, Stenogale, and Pseudictis. He includes in the latter family Prœlurus Filh. and denies that it is allied to the Nimnavidæ or Felidæ. He redefines the Ursidæ (under the name Amphicyonidæ), so as to include besides Ursus and Hyænarctos,—

[1] Die Affen, Lemur, Chiropteren, Insectivoren, Marsupialia, Creodonten u. Carnivoren des Europaischen Tertiärs; von Max Schlosser; 4 Tafeln; 4to. Alfred Hölder, Wien, 1888. II. Abtheilung.

Amphicyon, Dinocyon, Cephalogale, Simocyon, Oligobunis, and probably Enhydrocyon. In the Canidæ, Dr. Schlosser appears to us to admit too many genera; at least we cannot clearly make out generic differences from his descriptions. On the other hand the genera of Mustelidæ, though numerous, are sharply defined. We note a couple of errors in the matter of American species. *Canis brachypus* Cope is not an Eocene, but an upper Miocene species (Ticholeptus beds). *Aelurodon ferox* and *Canis saevus* cannot be well referred to different families, as they were established on the superior and inferior molars of the same species. Four plates accompany this memoir.—*E. D. Cope.*

MINERALOGY AND PETROGRAPHY.[1]

PETROGRAPHICAL NEWS.—There have recently appeared two interesting papers upon the Cortlandt series of eruptive rocks, and the changes they produce in the surrounding mica-schists and limestones. The first paper is by Mr. J. F. Kemp,[2] who reports the results of his examinations of an extension of the series west of Stony Point, N. Y. He finds the eruptives to be of the same general character as those described by Dr. Williams,[3] from near Peekskill. In one of these he notices the alteration of brown hornblende into green augite. He further finds that limestone upon the contact with these eruptives has undergone an alteration, during the course of which tremolite has been developed. Dr. Williams's[4] paper deals with the contact phenomena observed in the rocks surrounding the eruptives in the Stony Point region. The unaltered mica-schists consist of quartz, biotite, muscovite, a little feldspar, tourmaline, and occasionally zircon. Upon approaching the eruptives they lose their foliation and have developed in them: garnet, sillimanite, staurolite, scapolite, cyanite, margarite, ripidolite and corundum. The *sillimanite* is found in radiating bundles of fibres. The *ripidolite* (or clinoclor) is derived from the biotite of the schists. The *margarite* has the macroscopic appearance of muscovite. In the thin section, it is distinguished from this mineral by its high refractive index, its extinction of 6°–10°, its numerous twins parallel to oP, and its large optical angle (114½° in air). Its composition is:—

[1] Edited by Dr. W. S. Bayley, Colby University, Waterville, Me.
[2] Amer. Jour. Sci., Oct., 1888, p. 247.
[3] Cf. Amer. Naturalist, 1886, p. 275; 1887, p. 569.
[4] Amer. Jour. Sci., Oct., 1888, p. 254.

SiO_2	Al_2O_3	FeO	CaO	MgO	H_2O
32.73	46.58	5.12	11.04	1.00	4.49

The paper contains many points of interest, and is a final, incontrovertible proof of the eruptive character of the massive rocks of the Cortlandt series.—In a paper in which the origin of quartz in basalts is discussed, Mr. Iddings[1] describes the microscopic appearance of quartz-bearing basalts from the Rio Grande cañon in New Mexico. Most of these are holocrystalline. They contain plagioclase, augite, magnetite, olivine and rounded quartzes. The quartz is usually surrounded by shells composed of little augite crystals, which extend out into the body of the rock, and are sometimes partly included within the feldspar. It has the characteristics of the porphyritic crystals of more acid volcanic rocks, and is regarded as original. The main portion of the paper is taken up with the discussion of the conditions under which the production of porphyritic quartz crystals might take place in a rock as basic as basalt. After a thorough examination into the effects which temperature, pressure, and the presence of water vapor exert upon the crystallization of a molten magma, Mr. Iddings concludes that the quartzes owe their origin to certain physical conditions attending an early period of the magma's existence; and that of these the most important is the presence of water vapor under pressure. In the same paper the writer describes two new occurrences of quartz basalt. The first is a red compact rock from the vicinity of Santa Maria Basin, in Arizona. The second is a dark-colored, fine-grained rock from the S. E. base of Anita Peak, Colorado.—Kroustchoff[2] has recently described an inclusion in the basalt from Wingendorf, in Silesia, which differs from most basalt inclusions in that it contains anorthite. This mineral and enstatite make up the larger part of the inclusion, which contains in addition to these, augite, diallage, olivine and various spinels. The *enstatite* was separated and analyzed:—

SiO_2	Al_2O_3	FeO	MgO	CaO	Alkalies	Loss
56.96	.79	3.11	33.65	4.32	tr.	.26

—A coarse-grained pyroxene-syenite,[3] from near Gröbe, in Saxony, is composed of orthoclase, plagioclase, augite and biotite, with some quartz and hypersthene. The orthoclase occurs in porphyritic crystals, while the plagioclase is found only in the ground mass. In finer grained streaks throughout the rock the augite has all been replaced by hornblende.—In an article on Mount Lupara, a crater in the Flagraian Fields, near Naples, Deecke[4] describes augite-

[1] Amer. Jour. Sci., Sept., 1888, p. 208.
[2] Min. u. Petrog. Mitth., x., 1887, p. 329.
[3] Klemm: Zeits. d. deutsch. geol. Gesell., xl., 1888, p. 184.
[4] Ib., xl., p. 166.

trachyte and augite-trachyte glasses, which present no features different from those observed in the lavas of other craters in this region.—Mr. E. O. Hovey[1] reports the discovery of a cordierite gneiss at Guilford, sixteen miles east of New Haven, Conn. The cordierite has a deep blue color in the hand specimen, but under the microscope is colorless and very fresh. It contains as inclusions only sillimanite needles.—Lacroix and Baret[2] mention a pyroxenite from near Saint Nazaire, Loire-Inférieure, France, that is composed essentially of a granular mixture of augite, scapolite and sphene.—The microscopical examination and the determination of some of the physical constants of several sandstones, a marble and a tufa from California, have been made by Prof. A. W. Jackson,[3] of the University of California.

NEW MINERALS — HOHMANNITE AND AMARANTITE.—In a mass of copiapite from near Caracoles, in Chili, Frenzel[4] has discovered two new iron sulphates. One has been called *hohmannite* after its discoverer. This is an opaque chestnut-brown fibrous mineral, with a vitreous lustre. Its hardness is 3; specific gravity, 2.24, and its streak a yellow ochre color. Its composition may be represented by $Fe(FeO)(SO_4)_2 + 7H_2O$. It is insoluble in water, readily undergoes alteration, and loses 7.63 per cent. of water when placed in a dessicator over calcium chloride. The second mineral, *amarantite*, is probably identical with the first, although the author prefers to designate it by a separate name because of its different physical and chemical properties. Amarantite occurs in orange-colored microscopic crystals of the triclinic system.[5] They have a citron-yellow streak, and a specific gravity of 2.11, and do not as readily undergo decomposition as does hohmannite.—*Riebeckite.* In a flesh-red granite from the Island of Socotro, in the Indian Ocean, a hundred and fifty miles from Cape Gardafui, Sauer[6] has found a hornblende which corresponds exactly to aegerine among the augites. Its negative bisectrix (instead of positive as in the other hornblendes) is inclined 5° to the vertical axis, its pleochroism is vr = dark blue; t = green; pi = blue, and its composition:—

SiO_2	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O
50.01	28.30	9.87	.63	.34	1.32	8.79	.72

Sauer calls attention to the fact, so often overlooked, that the formula of *arfvedsonite*, which is usually regarded as equivalent to aegerine, is based upon an analysis which is really that of aegerine

[1] Amer. Jour. Sci., July, 1888, p. 57.
[2] Bul. Soc. Franç. d. Min. x., p. 288.
[3] Seventh Ann. Rep. State Mineralogist, Sacramento, 1888, p. 205.
[4] Min. u. Petrog. Mitth., ix., 1888, pp. 397, 423.
[5] Wülfing: ib., p. 401.
[6] Zeits. d. deutsch. geol. Gesell., 1888, xl., p. 138.

itself.—*Beryllonite.* In a preliminary note Prof. E. S. Dana[1] suggests the name *beryllonite* for a mineral with the composition Na Be Po_4, occurring in orthorhombic crystals with a tabular habit, a hardness of 5.5–6, and a specific gravity 2.84. The mineral is colorless or white, and has several perfect cleavages. A full description of its characteristics, as well as of its occurrences, is promised in the near future.—*Edisonite*—a fourth form of titanic oxide (a fifth form if Mr. Diller's[2] mineral is found to consist of TiO_2)—is described by Mr. Hidden[3] from the concentrates of placer washings in Polk county, N. C., and at Pilot Mountain, Burke county, in the same State. It crystallizes in the orthorhombic system like *brookite*, but its axial ratio, as calculated by Des Cloizeaux, is .99275 : 1 : .92337. The color of the mineral is yellow or brown, its hardness about 6, specific gravity 4.285, and streak yellowish white.

Rare Minerals.—*Bertrandite.* Heretofore this mineral has been found only in small crystals at various localities in Europe, and its crystallographic characteristics have not been thoroughly investigated. A new find at Mt. Antero, Colorado, affords Mr. Penfield[4] a crystal of sufficient size to admit of exact measurements of the crystallographic constants. According to Mr. Penfield, the mineral is orthorhombic with $a : b : c = .5723 : 1 : .5953$, and $2H = 101° 10'$ for yellow light. The hemimorphic development of the basal plane cannot be explained. The crystals are attached to quartz, and are associated with phenacite, orthoclase, muscovite and fluorite. They have a hardness of 6–7, a specific gravity of 2.598, and consist of:—

SiO_2	BeO	CaO	H_2O
51.8	39.6	1.0	8.4

Piedmontite. The optical properties of the manganese epidote piedmontite have recently been very carefully studied by Dr. Kotô,[5] of Japan, who finds it quite wide spread as a constituent of Japanese rocks. In a piedmontite-schist consisting of quartz, piedmontite, muscovite, garnet, rutile, feldspar, etc., the piedmontite is well crystallized with oP, ∞ $P\bar{\infty}$, $\frac{1}{2}$ $P\bar{\infty}$, P, and $P\bar{\infty}$ predominating. The mineral has an extinction of 3°, and is pleochrois as follows: vr = deep reddish violet; t = brownish red; pi = light violet. The absorption is vr > t > pi, whereas in common epidote it is t > pi > vr. An analysis yielded:—

SiO_2	Al_2O_3	Fe_2O_3	Mn_2O_3	CaO	MgO	K_2O	Na_2O	H_2O
36.16	22.52	9.33	6.43	22.05	.40	tr.	.44	3.20

[1] Amer. Jour. Sci., Oct., 1888, p. 290.
[2] Cf. Amer. Naturalist, Feb., 1888, p. 169.
[3] Amer. Jour. Sci., 1888, Oct., p. 272.
[4] Ib., July, p. 52.
[5] Quart. Jour. Geol. Soc., Aug., 1887, p. 474.

The same mineral is an accessory constituent of a glaucophane rock from Japan. It has recently been described, by Haworth,[1] as occurring in a porphyrite from Missouri, and is also mentioned by Lacroix[2] as existing in the mica-schists of the Island of Groix, off the coast of France.—*Emmonsite.* Near Brixlegg, in the Unterinnethal, is a mineral, occurring in little spherical groups of crystals implanted on barite. Its analysis gave 86.89 per cent. of $SrCO_3$, and 13.14 per cent. of $CaCO_3$, thus agreeing very closely with Thomson's *emmonsite* from Massachusetts. Cathrein[3] has measured the crystals, and found them to consist of rhombic prisms with $a : b : c = .6090 : 1 : .7236$.—*Diamonds and Sapphires.* A new discovery of diamonds and sapphires is reported[4] from Australia. The location where they have been found is Invere, New South Wales. They are found in a sand made up of quartz and tourmaline, and pieces of a rock composed of the same minerals.—*Leucite.* Prof. Judd[5] announces the discovery of leucite by Mr. T. W. E. David in a leucite-basalt from Byrock, N. S. Wales, Australia, about 450 miles N. W. from Sydney. Leucite, which until a few years ago was not known outside of Europe, is now known to occur in each one of the continents with the exception of Africa.—*Cryptolite*, the rare cerium phosphate, according to Mallard,[6] is nothing but *monazite* with a habit differing slightly from that which this mineral usually affects.—*Gadolinite* has been found, by Lacroix,[7] in a cavity in the granitite of the Mourne Mountains, Ireland, and *allanite* has been discovered, by Levy and Lacroix,[8] in a granite from Pont Paul, Finistère.

Crystallographic News.—In the course of an investigation of minerals from the Tyrol, Cathrein[9] detected in them several new planes. On a yellow-brown *garnet*, from Rothenkopf, $\frac{8}{3}$ O $\frac{8}{5}$ was found. This form is especially interesting, because it is not only new to garnet, but also to the entire regular system. The new triakistetrahedron— $\frac{\frac{17}{9} \text{ O } \frac{17}{9}}{2}$ occurs on *tetrahedrite* from Kogel, near Brixlegg; $\frac{39}{38} \text{P}\overline{\infty}$, $\infty \text{P}\bar{2}$ and $\frac{1}{7} \text{P}\breve{\infty}$ on *adularia* from Schwarzenstein; and $\text{P}\overline{\infty}$ on *diaspore* from Grenier.—In an elaborate paper on the crystallography of *dolomite* Becke[10] announces the dis-

[1] Amer. Naturalist, Aug., 1888, p. 732.
[2] Bull. d. l. Soc. Franç. d. Min., xi., p. 148.
[3] Zeits. d. Kryst., xiv., p. 366.
[4] Friedel: Bull. Soc. Franç. d. Min., xi., p. 64.
[5] Geol. Magazine, May, 1888, p. 193.
[6] Bull. Soc. Franç. d. Min., x., p. 236.
[7] Ib., xi., p. 68.
[8] Ib., xi., p. 65.
[9] Min. u. Petrog. Mitth., x., p. 52.
[10] Ib., x., p. 73.

covery of the new forms $+\frac{r}{1}\frac{\infty R3}{2}$, $+\frac{r}{1}\frac{4R3}{2}$, $-\frac{e}{r}\frac{2R3}{2}$, $-\frac{1}{r}\frac{R\frac{1}{3}}{2}$, $-\frac{1}{r}\frac{8R3}{2}$, $+\frac{1}{r}\frac{4R3}{2}$, $+\frac{1}{r}\frac{\infty R3}{2}$. As indicated by these formulas, Becke finds dolomite to be rhombohedrally tetrahedral. In addition to the full lists of forms occurring on the mineral, there is in the paper a full discussion of its vicinal planes. —*Pyrite*[1] crystals from the clay slates near Trofajach in Steiermark, contain the new plane $\frac{\infty O 6}{2}$. Michel[2] claims that crystals of the selenates of barium, strontium, calcium and lead are isomorphous with the natural sulphates of the corresponding metals.

MISCELLANEOUS.—Prof. Judd[3] has recently demonstrated in a very interesting paper that quartz may have secondarily developed in it a lamellar structure analogous to that which is so frequently produced in feldspar by pressure. The lamellæ in quartz are best brought out by etching. By studying the images reflected from the etched surfaces, Judd discovered that lamellæ existed only where the crystal examined had suffered injury; that the lamellæ were parallel to R and —R, which may be regarded as gliding planes; and finally that the change produced in the internal structure of the quartz consisted in a change in the nature of the circular polarization of the alternate lamellæ, and not in such a change as takes place in the development of twinning lamellæ in calcite and feldspar. It is thought that the planes along which a quartz crystal breaks when heated and suddenly cooled may be these gliding planes.—Prof. Crosby[4] discusses the origin of the silica that is often found cementing the grains in a sandstone, and suggests that it might result from the solution of siliceous organisms, which are everywhere abundant in the waters of the oceans, and may with some probability be assumed as occurring in the waters in which the sandstones were deposited.—Dr. E. A. Schneider[5] urges the importance of studying the effect of acids (especially hydrochloric) upon silicates, with the view of determining their constitution in a manner analogous to that so frequently made use of in organic chemistry for the purpose of determining the nature of the inner structure of carbonaceous substances.—Becke[6] proposes a method for distinguishing between quartz and feldspar in rock sections. It depends upon the fact that the former mineral is entirely dissolved by hydrofluoric acid, while the latter yields an amorphous aluminium fluosilicate, which can be stained with a solution of some aniline color.

[1] Hoefer: Ib., x., p. 157.
[2] Bull. d. l. Soc. Franç. d. Min., xi., p. 182.
[3] Miner. Magazine, 1888, p. 1.
[4] Technology Quarterly, May, 1888, p. 397.
[5] Amer. Chem. Jour., x., p. 405.
[6] Min. u. Petrog. Mitth., x., p. 89.

BOTANY.[1]

THE SO-CALLED "RESURRECTION PLANT."—M. Leclerc du Sablon describes (*Bull. Soc. Bot. France*, xxxv.) the curious property of revivification possessed by *Selaginella lepidophylla*. When the root withers, each branch curls up, and the plant appears more or less in the form of a ball. In this state it is able to remain for a long time, and then when the water necessary for its growth is supplied, the branches unroll, the green color which had almost disappeared returns, and the branches and roots re-commence to grow. The structure of the plant is such that when dehydration occurs, the cells on one side of a branch are thicker than those on the other, thus they contract unequally and cause the branch to curl up.—*Jour. Roy. Mic. Soc., Vug., 1888.*

PEDIASTRUM AND POLYEDRIUM.—Most botanists have had specimens of various species of both these genera under observation, and probably few have suspected their real relationship. The flat discs of the former certainly bear little resemblance to the caltrop-shaped groups of pointed cells of the latter. However, it appears that Askenasy has demonstrated that Polyedrium is but a stage of Pediastrum, or, to be more accurate, in statement, that *Polyedrium polymorphum* is a stage of *Pediastrum boryanum.*

THE PLANTS OF RHODE ISLAND.—James L. Bennett, of Providence, has prepared, and the Franklin Society has printed, a catalogue of the plants of Rhode Island, enumerating 2,928 species, besides 230 varieties. They are distributed as follows:—

Phanerogams.....	475 genera,	1,259 species,	101 varieties.
Cryptogams.....	494 "	1,669 "	129 "

Of the phanerogamous orders the following are the richest in species: Compositæ, 152; Cyperaceæ, 131; Gramineæ, 126; Leguminosæ, 52; Rosaceæ, 41; Labiatæ, 37; Scrophulariaceæ, 35; Ericaceæ, 32; Cruciferæ, 29; Ranunculaceæ, 28; Polygonaceæ, 28; Caryophyllaceæ, 27; Umbelliferæ, 27; Liliaceæ, 25.

The Cryptogams are represented as follows, viz.: Equisetaceæ, 4 species; Filices, 33; Lycopodiaceæ, 13; Characeæ, 8; Musci, 185; Hepaticæ, 74; Lichenes, 151; Fungi, 582; Algæ, 619.

The work of preparation has evidently extended over a considerable period, as in the preface it is stated that the Musci were determined by Mr. Lesquereux, and the Hepaticæ passed through the hands of Austin, who also aided in the determination of Musci,

[1] Edited by Prof. Chas. E. Bessey, Lincoln, Neb.

as did, also, Tuckerman for the Lichenes, and M. A. Curtis and Berkeley for the Fungi. The two groups last named were revised by Willey (Lichenes), and Peck and Ellis (Fungi).

The arrangement of the Phanerogams follows that of Bentham and Hooker, but that of the Cryptogams is in confusion, and is decidedly antiquated, particularly so in the Fungi. However, the list is a very useful one, and a credit to author.

WATSON'S CONTRIBUTIONS TO NORTH AMERICAN BOTANY, XV.—In this contribution the new cruciferous genus Lesquerella is described. It includes American species hitherto referred to Vesicaria, and Alyssum, with a few species here described for the first time, making thirty-three in all. A revision of the North American species of Draba is given, including descriptions of two new species. Thirty-two species are recognized.

Among the more notable new species described may be noted—a Trifolium (*T. howellii*) from southern Oregon; a Pyrus (*P. occidentalis*) from Washington Territory to California; a Pentstemon (*P. shockleyi*) from Nevada; a Calochortus (*C. howellii*) from Oregon; and a Tillandsia (*T. wilsoni*) from Florida. A new genus of Eupatoriaceæ is described under the name Hartwrightia, represented by a single species (*H. floridana*) from Florida. Both genus and species are credited to Dr. Gray, who recognized them as distinct, but delayed publication in order to await better material.

Many interesting species of Mexican and Guatemalan plants are described in Parts 2 and 3 of the paper. Prionosciadium, near Angelica in Umbelliferæ, and Louteridium in Acanthaceæ, are the two new genera described, the first represented by three Mexican, and the second by one Guatemalan species, the latter bearing the highly objectionable name of *L. donnell-smithii*.

CANADIAN PLANTS.—Part IV. of the Catalogue of Canadian Plants, by John Macoun, completes the list of flowering plants. The list includes 2,955 species. Two more parts are still to appear; Part V. to be devoted to the ferns and their allies, and the mosses and liverworts; and Part VI. to lichens, fungi and algæ.

ENGELMANN'S BOTANICAL WORKS.[1]—When Dr. George Engelmann died, in 1884, his botanical writings were scattered through the pages of so many publications as to make much of his work inaccessible to the ordinary student. This has been remedied by Henry Shaw, the well-known philanthropist of St. Louis, through whose liberality the scattered writings have been brought together

[1] The Botanical Works of the late George Engelmann. Collected for Henry Shaw Esq. Edited by William Trelease and Asa Gray. Cambridge, Mass.: John Wilson & Son, University Press, 1887. 4to.

in a handsome quarto volume of 548 pages, and nearly one hundred full-page plates.

The title-page bears the names of William Trelease and Asa Gray, as editors. In the preface, which bears date of March, 1887, Dr. Gray states that "the classification and arrangement of the papers, and essentially the whole editorial labor, has devolved upon the Engelmann Professor in the Shaw School of Botany, Dr. Trelease, under my supervision." The biographical sketch which appears in the volume is the same as that prepared for the American Academy of Arts and Sciences by Dr. Gray, and afterwards published in the Proceedings of the Academy, and also in the *American Journal of Science.*

The contents of the volume may be summarized as follows: 1. De Antholysi Prodromus (a Latin dissertation on Teratology). 2. Sketch of the Botany of Dr. A. Wislizenus's Expedition (from Missouri to Santa Fé). 3. Papers on Cuscutineæ (six in all). 4. Papers on Cactaceæ (twelve in number). 5. Papers on Juncus (two). 6. Papers on Yucca, Agave, etc. (eight). 7. Papers on Coniferæ (twelve). 8. Papers on American Oaks (four). 9. Papers on Vitis (six). 10. Papers on Euphorbiaceæ (six). 11. Papers on Isoetes (three). 12. Shorter miscellaneous papers (eleven). 13. Lists, and collected Descriptions of Plants (ten). 14. General Notes (three).

The engravings which illustrate the papers were in some cases printed from the original plates, while in others new plates had to be made, the originals having long since been destroyed. The volume is a most valuable one, and reflects great credit upon all concerned in its production.—*Charles E. Bessey.*

Algæ Growing on Animals.—Three species of algæ, belonging to two genera, have been recently described as occurring on the hairs of Sloths. The green species is placed in the new genus *Tricophilus* in the family Chroolepideæ, and the violet ones in the genus *Cyanoderma*, also new, of the family Chamæsiphoneæ. It has been estimated that as many as 150,000 to 200,000 individuals often occur upon a single hair.

The Use of Tannin in the Plant.—The suggestion has recently been made by Professor Hillhouse that tannin may be developed in plants as a protection against the attacks of fungi.

Ravenel's Herbarium.—This valuable collection is offered for sale by the widow of the late H. W. Ravenel, at Aiken, S. C. It should be secured by some college, and given a permanent home where it may always be accessible to students of the fungi.

ZOOLOGY.

A Probable Case of Instinct at Fault in Bees.—While staying for a day at a ranch in the valley of South Platte, in Colorado, a few years ago, I found some excellent honey served upon the ranchman's table. He informed me that he had undertaken to keep bees, but that he had lately had "bad luck" with them, which were new swarms that he had only the year before brought from his former home in Illinois; and he gave me the following account of his experience with them. He said that upon the appearance of flowers in the spring his bees became very active and quickly filled with honey not only the main hives, but all the accessory boxes which he attached to them. The comb was clean and perfect and the honey good. In the midst of the season of abundant flowers he observed that his bees began to diminish in numbers, and while flowers were yet abundant his hives became well nigh depopulated, and few or no new swarms were ever produced. Upon opening some of the forsaken hives he found them filled with comb, nearly or quite every cell of which was filled with honey. The hives seemed to be in excellent condition, and he found no trace of the presence of any enemy of the bees.

I examined one of the opened hives, which yet contained a portion of the honey in its comb, and so far as I could see, its condition entirely agreed with the ranchman's statements. I also observed that his hives had been placed in the midst of many acres which were mostly covered with a natural and luxurious growth of the plant *Clione integrifolia* Torrey & Gray, from the flowers of which the bees had evidently obtained their honey.

I am well aware that the foregoing statements as they were made to me, even when supplemented with such personal observations as I was able to make, are not sufficient to base a scientific conclusion upon; but accepting the statements as true, I offer the following suggestions as probably indicating the cause of the rapid extinction of those bees under circumstances that were apparently the most favorable for their preservation and increase.

The plant upon which the bees worked, *Clione integrifolia*, flowers abundantly and continuously through several months of spring and summer. The flowers are so laden with nectar that one plainly tastes it upon plucking the corollas and sucking the tubes. The distance from the abundant flowers to the hives was so short that the bees could obtain the honey with remarkably little labor.

Packard states that the life of working bees of the first brood of the season is about six weeks. Some apiarists think that during the season of most active labor the life of those bees does not exceed

a month. May it not, therefore, have been the case that the workers to which fell the task of collecting honey brought it in such quantities and, so quickly, that all the comb-cells were filled before the queen had an opportunity to deposit her eggs? If this were the case the swarms necessarily became extinct by the natural limitation of the life of individual bees, because of the failure to keep up their numbers by breeding. In short is not this a case in which the instinctive struggle for existence defeated its object?

I have no intention of drawing a parallel between this case of disastrous results to bee-life under apparently normal and unusually favorable conditions, and a certain phase of human society, but if the foregoing suggestions are of little value for want of scientific verification they are believed to be deserving of consideration from other points of view.—*C. A. White.*

THE CALCAREOUS PLATES OF THE STAR-FISH.—Dr. J. W. Fewkes (*Bulletin Mus. Comp. Zool.*, XVII., 1888) describes at length the development of the calcareous plates in Asterias, and compares the results with those furnished by Amphiura. The results of the comparison may be tabulated thus:—

Amphiura.	*Asterias.*
Basals.	Genitals.
Dorso-central.	Dorso-central.
Dorsals.	Dorsals.
Laterals.	Inter-ambulacrals.
Terminals.	Terminals.
"Spoon-shaped plates."	Oral Ambulacrals.
Orals.	First Inter-brachials.
First and second Adambulacrals.	No Homologues.
Ventrals.	No Homologues.
No Homologues.	Dorso-laterals and connectors.

The madreporic opening is placed on two homologically different plates in Amphiura and Asterias.

A NEW EARTHWORM.—Under the name *Diplocardia communis*, H. Garman describes (*Bulletin Ill. State Lab. Nat. Hist.*) a new earthworm from Champaign, Ill. This new genus belongs to the family Acanthodrilidæ of Claus, but it differs from the other members of the family in several important characters. Its nearest relation is Acanthodrilus of Africa and the Orient. Among the most noticeable features are the absence of a sub-neural vessel, the existence of a double dorsal vessel, the two halves being separated throughout their length, except where they pass through the dissipiments between the somites. Although not mentioned by Mr. Garman, this character of the central circulatory organ pos-

sesses considerable morphological interest when taken in connection with the method of formation of the "heart" in many Arthropods, *e.g.*, Branchipus (Claus) and Oecanthus (Ayers). The paper concludes with a valuable catalogue of the known American species of earthworms, which we summarize here:

Family LUMBRICIDÆ.—Genus *Tetragonurus* Eisen, *T. pupa* Eisen.——Genus *Allolobophora* Eisen, *A. bœckii* Eisen, *A. riparia* Hoffmann, *A. fœtida* Savigny, *A. subrubicunda* Eisen, *A. mucosa* Eisen, *A. turgida* Eisen, *A. tenuis* Eisen, *A. tumida* Eisen, *A. parva* Eisen, *A. nordenskioldii* Eisen.——Genus *Lumbricus* Linné, *L. herculeus* Sav., *L. rubellus* Hoffmann, *L. purpureus* Eisen.

Family ACANTHODRILIDÆ.—Genus *Diplocardia* Garman, *D. communis* Garman.

Family PLUTELLIDÆ.—Genus *Plutellus* Perrier, *C. heteroporus* Perrier.

Family PERICHÆTIDÆ.—Genus *Perichæta*. Mr. Garman states that an undetermined species of this oriental genus has been acclimatized in the green houses at Champaign, Ill.

ISOPOD ANATOMY.—B. Rosenstadt (*Biol. Centralbl.* VIII., 452, 1888) describes many points in the anatomy of *Asellus aquaticus* and other Isopods. Besides concise accounts of the vascular, nervous, and digestive systems, the author mentions the existence of a rudimentary antennal gland similar to that found in Apseudes and Praniza. In Asellus he found in addition a convoluted canal on either side of the "stomach," which resembled the "shell-gland" of the Entomostraca. The opening of the gland occurred at the base of the second maxilla, and its lumen contained concretions of urates (so shown by Murexide test); points which demonstrated its homology with the shell-gland of the Entomostraca. This is its first recognition in the Malacostraca, though the author found it later in Porcellio, Idotea, Nesæa, Cymothoa, and Jæra.

THE LARVA OF PROTEUS.—Dr. Ernst Zeller has been so fortunate as to have a *Proteus anguineus* lay seventy-six eggs in captivity, from which in ninety days two larvæ hatched. According to his description in the *Zoologischer Anzeiger* (Bd. XI., p. 570, 1888), the larvæ when hatched were more developed than is the case in Amblystoma and the "Axolotl," and measured 22 mm. in length, of which five belonged to the tail. The general appearance was much like that of the adult. The pale red gills are shorter and less developed than in the adult; the anterior limbs are well developed and three-toed, but the hinder pair are still stump-like. The development of the small black eyes is noticeable, as is also the development of pigment in various regions of the body. A few points are mentioned concerning the embryonic

development, and of the larvæ for two weeks after development, when they possessed two toes to the hind feet.

THE NEST AND EGGS OF THE ALLIGATOR.—Dr. S. F. Clarke thus describes the eggs of the alligator in a recent number of the *Zoologischer Anzeiger*. The eggs and young alligators are such common objects in the shop windows in many of the Southern States, that it appeared to be a simple matter to secure the eggs at the right time and in abundance. It proved, on the contrary, to be very difficult. I was assured by various hunters in Florida that each month from January to September inclusive, was the only month in which the alligators lay their eggs, and this resulted in my having to make two journeys of over twenty-six hundred miles each.

At the time of my first visit, the first week in April, all eggs had been laid, and the ovaries of adult female alligators were full of eggs of all sizes up to 26 mm. in diameter. I returned to Florida June 4th, and found that I was still somewhat early, as the nests were then being built. With the aid of five experienced hunters I at last succeeded in finding, on the 9th of June, a nest, evidently just completed, in which there were twenty-nine eggs. The next day, at a point forty miles further north, a second nest was found with thirty-one eggs. There were many nests found, old and new, but only these two contained eggs.

The nests vary much in size, the largest being about 2½ metres in diameter at the base, and 80 cm. high in the central part, the whole having the shape of a rounded cone. They are located generally on a slightly elevated place, which is higher by a metre, or slightly more than the surrounding level, and covered with a thick growth of palmettos, mangroves, magnolias, etc. These are called "hummocks" by the natives. On one side of the hummock at least, in some cases on all sides, is a pond from one to two metres in depth, and in the bank, under water, the female alligator digs a cave, which in some cases extends three metres under the hummock, and which is always close to her nest. The nest is made by scratching together a great pile of dead leaves and twigs and humus which forms the surface of the ground, and which is arranged with some care. The inside is made of the more finely divided—almost powdery—material of the deeper layers of the top soil, while the outside, even to the top, is covered with twigs and leaves which are whole or but little broken, and with many of the long, unbroken leaves or needles of the southern pine. The eggs are deposited about 20 cm. from the top, and in the nests were found lying on top of one another, making rows or layers, with the fine humus filling all the interstices. The top of the nest is always exposed to the sun.

Dr. Clarke describes the eggs as very difficult to manipulate, as

the shell membrane is tough, and the white very sticky. Before studying his eggs he took them to Williamstown, Mass., but before arriving there they had undergone a part of their development, and the neural folds had nearly completed their coalescence.

ANATOMY OF BIRDS.—Mr. F. E. Beddard (*P. Z. S.*, London, 1888) gives an account of the alimentary tract and syrinx of *Balæniceps rex*, from which, and from the previously known osteological peculiarities, he regards this bird, "in fact, as a rather aberrant heron, having no near affinities with the storks, nor to Scopus." In the same volume he has some notes on the visceral anatomy of the penguins and puffins, dealing especially with the oblique septum of these birds, and the morphological and taxonomic conclusions to be drawn therefrom. He is inclined to homologize it in details with a fibrous and even muscular structure found in the crocodile. Dr. R. W. Schufeldt (*Jour. Comp. Anat. and Surgery*, October, 1888) gives a much needed account of the osteology of the Jungle-fowl, *Gallus bankiva*. He also treats of several other important structures in the same bird, which is of especial interest as being the ancestor of all of our domestic fowl. Some thirty process figures illustrate the chief points in the article.

ENTOMOLOGY.[1]

COLOR-RELATIONS BETWEEN PUPÆ AND THEIR SURROUNDINGS.—Students of Lepidoptera often observe variations in the color of different pupæ of the same species, that have apparently been caused by the color of the object to which the pupa is attached. Striking instances of these variations came under the observation of the writer during the past summer, when breeding *Papilio asterius*. Pupæ attached to green leaves were bright green in color, while others attached to the sides of a breeding-cage closely resembled in color the wood upon which they were.

This class of phenomena has been made the subject of careful study by several English entomologists. The more important of the papers published are two in number. The first, by Mr. E. B. Poulton,[2] was read before the Royal Society of London last year. Since that time Mr. George C. Griffiths has carried the matter farther, and the results of his experiments have just been published by Mr. William White.[3]

[1] This Department is edited by Prof. J. H. Comstock, Cornell University, Ithaca, N. Y., to whom communications, books for notice, etc., should be sent.

[2] Philosophical Transactions, Vol. clxxviii., B., 1887, pp. 311–441.

[3] Trans. Entomol. Soc., London, 1888, pp. 247–267.

Previous to these writings, observers had freely stated that it was the habit of chrysalides to assume the precise coloration of the surface to which they were attached, and the untested facts of the case had been considerably exaggerated. In explanation of the phenomena in question, the earlier writers held that these correspondences of color were analogous to those of the Chameleon, or that they were photographic. Attention was called to the transparent surface of the freshly formed pupa, which might be sensitive to light. Professor Meldola, however, had modified such statements by declaring [1] that "the action of light upon the sensitive skin of a pupa had no analogy with its action on any known photographic chemical. No known substance retained permanently the color reflected on it by adjacent objects."

This represents the state of our knowledge at the time of the publication of Mr. Poulton's memoir. In this paper the results of many experiments are tabulated. Some of them are very striking. Thus, in the case of pupæ of *Vanessa*, exposed to gilded surroundings, many of them appeared as if they had been covered with gold leaf. This memoir is a difficult one to abstract, owing to the great amount of details. The following appear to be the more important conclusions:—

1. There is a great difference with regards to the sensitiveness of different species. Thus he proves that the pupæ of the following named butterflies possess an adjustable color-relation to their surroundings: *Vanessa io, V. urticæ, V. atalanta, Pieris brassicæ,* and *P. rapæ*, while, on the other hand, dimorphic pupæ, which are closely allied to the sensitive forms, may be uninfluenced by surrounding colors, *e.g.: Papilio machaon* and *P. polydamus.* In the genus Ephyra (Heterocera) the dimorphic pupæ are quite uninfluenced by their surroundings, the pupal colors corresponding to those of the dimorphic larvæ.

2. The previously accepted theory, which explained the pupal color-relation as following from the action of light upon the moist skin of the freshly-formed pupa, is entirely disproved, and it is shown that the influence works upon the larva during the period which intervenes between the cessation of feeding and pupation. This intervening period was carefully investigated in *V. urticæ*, and it was found that, after ceasing to feed, the larvæ wander for a variable time, then rest for about fifteen hours upon the surface selected for pupation, and finally hang suspended, head downwards, for about eighteen hours, after which time pupation takes place. By transferring the larvæ from one color to another, it was found that the color influence works for about twenty hours preceding the last twelve hours of the whole period.

[1] Proc. Entom. Soc., London, 1874, p. XXIV.

3. Blinding proved that the eyes do not form the organs which are influenced, and it was also shown that the complex bristles do not contain a terminal organ with this function. Experiments with conflicting colors appear to prove that surrounding colors affect the whole surface of the larval skin, although parti-colored pupæ were not obtained. (There is, however, some evidence of such a result in *Papilio nireus*.)

4. In all cases there are certain colors which produce no effects. In Vanessa the brilliant metallic tints of the pupæ can be greatly influenced by the presence of gilded surfaces in the environment of the larva before pupation. This fact appears to prove that the metallic tints are essentially protective, and probably subserve concealment by their resemblance to glittering minerals, such as mica. This theory is confirmed by observations upon the habits of certain species with gilded pupæ. At the same time the gilded appearance has acquired another and opposite significance in other species, being of use in rendering the pupæ conspicuous, and thus acting as a signal of an unpleasant taste or smell.

5. The amount of pigment in the superficial layer of the cuticle in the pupæ of *Pieris brassicæ* and *P. rapæ* appears to be influenced by the spectroscopic composition of the light incident upon the larvæ before pupation.

The experiments of Mr. Griffiths, as summarised by Mr. White, confirms Mr. Poulton's observations in the following particulars: (1) Dark surroundings exercise a retarding influence upon the period before pupation. (2) The freshly-formed pupa is *not* photographically sensitive, but the period during which the larva rests motionless upon the selected surface is the time of chief susceptibility. (3) The general results of the colors themselves also entirely confirm Poulton's observations, notably in the case of dark pupæ produced by black, and of green pupæ produced by yellow. (4) The special effects of yellow surroundings in arresting the formation of dark superficial pigment, and in tending towards the production of green pupæ, were very striking, and confirm Poulton's suggestion that rays from this part of the spectrum, when predominant in the light incident upon the susceptible larva, determine the production of these results whenever green pupæ are produced by the influence of surroundings. When green pupæ of Pieris are produced, as in nature, on green leaves, it is probable that the effect is wholly due to the reflected yellow rays. Though these experiments do not exactly furnish materials for new conclusions, they are valuable as independent corroborations of Poulton's results.

Serious Injury to Apples by the Plum Curculio.—During the latter part of the past summer my attention was

attracted to a serious injury done to the fruit in an apple-orchard through which I passed daily. A large proportion of the apples in one corner of the orchard had been eaten into by something which made small pits from one-eighth to one-fourth inch in diameter, and of about the same depth. On one tree nearly every apple had been attacked, and in many cases there were ten or twelve holes in a single apple. The injury was so serious as to render the fruit in this part of the orchard unmarketable.

The holes in the apples were first observed during the latter part of August. At that time many of them were partially grown over, while others were fresh, indicating that the pest had been at work for a considerable time, and was still active. As the injury to the apples resemble somewhat that caused by a climbing cut-worm, that sometimes infests apples in western New York, I at first searched for caterpillars, and gave little thought to the plum curculios that I frequently found hiding in the pits in the apples. But, after finding a considerable number of these insects in these pits, it occurred to me that they might be the cause of the mischief. Several perfect apples were then selected and placed in breeding-cages, in each of which were confined several curculios. The question was soon settled. Within twenty-four hours the beetles had begun to eat into the apples. They made small holes at first, but these were soon enlarged so as to form pits of the size indicated above.

The results of this experiment are of special interest at this time as confirming the observations referred to in the next note.—*J. H. Comstock.*

Poisoning the Plum Curculio.—In referring to some experiments made by me to prevent curculio injuries, in the August Naturalist, the question is raised as to how spraying with poisons may have a preventive effect on this insect. I believe that a satisfactory explanation may now be given. Early last June I confined an adult curculio in a jar with a large green plum, and was surprised at the avidity with which the fruit was eaten. A large portion of the surface was gnawed out for food, and not for purposes of oviposition, and the feasibility of poisoning the adult beetles by coating the fruit with poison is clearly shown.

But even more satisfactory breeding-cage experiments were made in Illinois, by Professor Forbes, who informs me that he has found that, besides gnawing out the fruit, the adult curculio eats freely of the substances of the leaves. He adds that the curculios "are certainly very freely exposed to destruction by poison, without reference to the habits of oviposition or the first food of the larvæ;" and that he has "also learned experimentally that spraying the leaves with Paris green would poison the beetles completely."

Professor Forbes discussed at some length the details of his experiments, which confirm the conclusions reached in my experiments, in an address delivered at a meeting of the Central Illinois Horticultural Society during last August. (*Prairie Farmer*, August 11, 1888.) Professor A. J. Cook, of the Michigan Agricultural College, also announces, in Bulletin No. XXXIX., similar results.—*Clarence M. Weed, Ohio Agricultural Experiment Station.*

Smith's Monograph of the Sphingidæ of Temperate North America.—Parts II. and III. of the current volume of the *Transactions of the American Entomological Society* are devoted to a "Monograph of the Sphingidæ of Temperate North America," by Mr. John B. Smith. This paper makes a volume of nearly 200 pages. It appears to be very complete, and very carefully written. The synonymy of each species is given; the adult is fully described, and descriptions of the early stages are also given whenever they are known. The work abounds in valuable critical notes. Analytical keys for the separation of genera and of species are furnished. The paper concludes with a synonymical list. Eighty species are enumerated in this list. This work should be in the hands of every student of American Lepidoptera.

EMBRYOLOGY.[1]

Development of Meloe.—Josef Nusbaum describes briefly (*Biol. Centralblat.*, VIII., p. 449-452) the development of the oil beetle, Meloe. This form is very convenient for embryological studies as it breeds well in confinement and lays little piles of eggs, all the eggs in a single pile developing synchronously. The segmentation nucleus is central and the cells resulting from the segmentation migrate slowly to the surface, the protoplasm forming a reticulum in the meshes of which the yolk is embraced. Some of these cells reach the surface to form the blastoderm while others remain behind to form "yolk cells." On the third day the ventral plate and the rudiments of the amnion appear very early the ventral plate becomes segmented, and paired appendages appear on every segment of the body. The primitive groove appears at the same time as the amnion and develops from behind forward. It soon closes and forms a tube with a very narrow lumen behind, in front a solid cellular in-pushing. This is regarded as gastrulation, and the portion thus invaginated as ento-mesoderm or primary entoderm,

[1] Edited by Prof. John A. Ryder, Univ. of Penna., Philadelphia.

from the hinder portion of this cells, are cut off, which wander in and join the "yolk cells," but have nothing to do with the formation of the mesenteron. The remainder of the primary entoderm differentiates into two large lateral and a middle solid longitudinal band, and in the former there appears in each segment a cavity. The outer wall of this cavity forms the somatopleure, the inner the splanchnopleure and epithelium of the digestive tract. This inner wall soon separates completely from the outer in the middle line, and there becomes two-layered, thus developing both entoderm and splanchnopleure. These lateral bands of entoderm now unite with the middle one and soon enclose the whole yolk and the "yolk cells" which latter later degenerate and are absorbed.—*J. S. K.*

MICROSCOPY.[1]

VITAL INFUSION OF NERVES WITH METHYL-BLUE.—Prof. Ehrlich's[2] experiments in staining nerves with *methyl-blue*, mark the second great advance in staining *living* tissues. The discovery of a veritable nerve-stain, that acts *intra vitam*, has already led to the settlement of many disputed points, and promises to furnish a means for deciding the problem of nerve-endings. The well-known color-reaction induced in newly formed bone-substance as the result of madder-feeding, is outshone by this wonderful reaction between methyl-blue and the axis-cylinder.

According to Ehrlich two conditions are necessary in order to get the methyl-blue reaction: These are (1) *saturation with oxygen* and (2) *alkaline reaction*. The first condition can be secured only by free exposure of the object to the air. If a cover-slip is used, the air is thus excluded, and the stain rapidly disappears.

As to the second condition, it is known that nerves at rest have an alkaline reaction. It is necessary, therefore, to experiment on *resting* nerves. The state of rest may be forced by severing the nerves before infusion with methyl-blue, or by poisoning the animals with curare. The nerve-endings of the retina may be studied on animals that have been kept some time in the dark before infusion. The number of nerve terminations that stain under ordinary conditions is, however, so great, that a wide field for histological investigation is open to us without having recourse to the expedients just mentioned.

[1] Edited by C. O. Whitman, Director of the Lake Laboratory, Milwaukee.

[2] P. Ehrlich. Ueber die Methylenblaureaction der lebenden Nervensubstanz. Deutsch. med. Wochenschr., 1886, No. 4.

The evanescence of the color-reaction is a serious drawback, but this difficulty has been met with some success by the use of iodine and picro-carmine as "fixing" reagents.

The method of procedure, according to Prof. C. Arnstein,[1] and his pupils, Dogiel and Smirnon, is as follows:—

1. Inject the *vena cutanea magna* of a frog with 1 cc. of a saturated solution of methyl-blue. The tongue and palate are at once colored, but the coloring substance is confined to the blood-vessels, and does not at first affect the nerves. After an hour or two the nerves supplying the taste papillæ appear blue, and at the same time the nerve-meshes of the palate are also stained. The motor nerve-ends show the stain a little later. The color-reaction only lasts a short time, often not more than five to ten minutes. It should be fixed at the moment of its greatest intensity. If iodine is used for this purpose, proceed as follows:—

2. Place the frog in a 1 per cent. aqueous solution of potassic iodide, in which metallic iodine has been dissolved to saturation, and inject the blood-vessels with the same solution, thus freeing them from the blood as far as possible.

3. Next cut out the parts needed and leave them in the iodine solution from six to twelve hours.

4. Transfer to water and leave until most of the iodine has been withdrawn. As the result of this treatment, the nerves will have a dark brown or grey color, and the surrounding tissue will be nearly colorless.

5. Mount in acidified glycerine.

Picro-carmine as a "fixing" agent, is said to give more durable preparations than iodine, but the latter gives the more intense color.

Mammals and birds die soon after injection of methyl-blue, so that a true intra vitam reaction can not be easily obtained. However, a very satisfactory reaction may be obtained, with these animals, after death from chloroform. The injection may be made from the heart or from any blood-vessel. The appearance of color in the nerves can be followed under the microscope, and when its maximum has been reached, the fixing reagent applied.

Finally, with a dilute solution of methyl-blue, preparations can be stained *directly on the slide.* The retina of fishes, birds, and mammals, can be more successfully stained this way than by injection.

Dr. Max Joseph[2] has tested Ehrlich's method on Heteropods and found that the clear intra vitam stain could not be satisfactorily fixed. He remarks that *the commercial methyl-blue is unfit for use,*

[1] Anat. Anz. ii., 1887, No. 5, p. 125, and No. 17, p. 551.
[2] Anat. Anz., June, 1888, No. 15, p. 420.

and that *only the chemically pure article will give the results obtained by Ehrlich.*

Instead of a saturated solution, Dr. Joseph recommends the strength originally employed by Ehrlich,—*one-quarter gram color in 100 grams of the physiological salt solution.*

The best stain was reached about six hours after injection in the body-cavity.

Biedermann[1] has employed nearly the same method for Crustacea and insects.

Central Termination of the Optic Nerve in Vertebrates.[2]—For tracing the course of nerve-fibres, the following method has been employed with great success by Prof. Bellonci.

1. The brain, or a part of it containing the nervus opticus, is placed in osmic acid ($\frac{1}{2}$ to 1 per cent.) for fourteen to twenty hours.

2. Sections are then made with free hand in alcohol of 70 per cent.; the sections are washed in distilled water a few minutes, and then placed in 80 per cent. alcohol three or four hours.

3. The sections are again placed in distilled water, and then transferred to the object-slide, and covered with a cover-slip.

4. A few drops of ammonia are then allowed to mix with the water under the cover-slip. This reagent makes the brain transparent as glass, with exception of the nerve-fibres, which remain black, and which are brought out with such distinctness that their course is easily followed.

The sections are of course thick, but this is an advantage in tracing the winding course of the fibres.

Sections cut in celloidin with the microtome can be treated in same manner, but the action of the ammonia is much slower, requiring several days.

Double-staining of the Central Nervous System.[3]—1. Of the various fluids used for hardening, a *3 to 4 per cent. solution of bichromate of potassium* gives the best results. The object must be in a fresh condition when placed in the fluid, and the fluid must be changed often during the process of hardening.

2. The sections are best when made, without imbedding in celloidin, from pieces fastened to cork with gum and then placed in alcohol long enough to harden the gum.[4]

[1] Sitzb. d. Kaiz. Akad. d. Wissensch., Vol. xcvi., 3 Abth. 1887.

[2] *Josef Bellonci.* Ueber die centrale Endigung des Nervus opticus bei den Vertebraten.
Zeitschr. f. wiss. Zoologie, xlvii., I., p. 4, September, 1888.

[3] *Hermann Sahli.* Ueber eine neue Doppelfärbung des centralne Nervensystems. Zeitsch. f. wiss. Mikroskopie, ii., I., p. 1, 1885.

[4] Preparations left several days in alcohol can still be used. But the sections should be laid in the bichromate of potassium for an hour, and

3. The sections are placed in water for a few minutes (not over five or ten), and then in a saturated aqueous solution of *methyl-blue* until stained deep blue.

4. They are then washed, and placed in a saturated aqueous solution of acid fuchsin for about five minutes.

5. The sections are next to be quickly washed, and placed for a *few seconds* in an alcoholic solution of caustic potash (1 per cent.), from which they are to be transferred at once to abundant water.

The color differentiation at once appears: The white matter becomes blue or violet, and the gray matter red. Bundles of fibres in longitudinal section appear to be made up partly of blue and partly of red fibres. Cross-sections show that the difference in color among the fibres is due to the presence in varying amount of two unlike substances in the medullary sheaths. These substances may be distinguished as *erythrophilous* (red) and *cyanophilous* (blue). The axis-cylinder is uniformly red, while the medullary sheaths are variegated. In some fibres the whole sheath is made up of cyanophilous matter, in others of erythrophilous matter. In the majority of the fibres, the sheath is composed of concentric layers, blue alternating with red.

In the gray matter of the spinal chord may be seen Gerlach's net-work of fine fibrils. Close examination shows that the fibril is differentiated into red axis-cylinder and blue medullary sheath.

Preparations after the above method are not permanent, but they sometimes keep for a year or more.

Such preparations show that the medullary sheath is a structure of more importance than has generally been supposed by physiologists and pathologists. The differences brought out by this process of double-staining appear to indicate a difference in function among the nerve-fibres. The division into *motor* and *sensory* fibres, as Sahli suggests, may not go to the root of the matter. The central nervous system may be built up on a much more complicated principle of division.

PROCEEDINGS OF SCIENTIFIC SOCIETIES.

KENT SCIENTIFIC INSTITUTE OF GRAND RAPIDS, MICH.—The following officers were elected to serve for the year 1888: President, E. S. Holmes; Vice-President, W. A. Greeson; Recorder, C. A. Whittemore; Corresponding Secretary, E. S. Holmes; Treas-

then washed a few minutes in water (until visible streams of the solution cease to issue from the preparation), before immersion in the staining fluid. The staining may be successful with celloidin sections, provided they are very thin. It is better, however, to remove the celloidin, and subject the sections again to the hardening fluid, preparatory to staining.

urer, Samuel L. Fuller; Director of Museum, W. A. Greeson; Curator of Museum, C. W. Carman; Librarian, Geo. E. Fitch. Board of Directors: for one year, Joel C. Parker; for two years, Wright L. Coffinberry; for three years, W. A. Greeson; for four years, Samuel L. Fuller; for five years, E. S. Holmes; for six years, J. W. Jones.

BIOLOGICAL SOCIETY OF WASHINGTON.—At the meeting held October 20th, 1888, the following communications were read: Mr. L. O. Howard, "An Apparatus for the Study of Underground Insects and Plant-Roots;" Prof. Lester F. Ward, "The King Devil;" Mr. J. B. Smith, "Some Remarks on Sexual Characters in Lachnosternum;" Dr. Theo. Gill, "The Families of Fishes."

November 3, 1888.—The following communications were read: Mr. F. H. Knowlton, "Fossil Wood and Lignites of the Potomac Formation;" Mr. W. H. Dall, "Observations on the Modifications of the Gill in Univalve Molluscs;" Dr. Theo. Gill, "Characteristics of the *Scatophagidæ;*" Dr. C. Hart Merriam, "Description of a New Species of *Arvicola* from the Black Hills of Dakota."

November 17, 1888.—Prof. Lester F. Ward, "A Comprehensive Type of Fossil Cryptogamic Life from the Fort Union group, with Lantern views;" Mr. F. H. Knowlton, "Illustrations of Fossil Wood and Lignites of the Potomac Formation with Lantern views;" Dr. Cooper Curtis, "Some sexual differences in Trichocephali;" Prof. B. F. Fernow, "Geotropism and Heliotropism of Trees;" Dr. Theo. Gill, "On the relations of the Pscychrolutidæ;" Dr. C. Hart Merriam, "Description of a new Ground Squirrel from California."

U. S. NATIONAL ACADEMY OF SCIENCES.—Papers read November, 1888, in New Haven.—I. "The Lunar Eclipse, July 22, 1888,"[1] by E. S. Holden. II. "The Zone Undertaking of the Astronomische Gesellschaft," by Lewis Boss; presented by A Hall. III. "The Rain-Fall of the North Atlantic Ocean,"[2] by Elias Loomis. IV. "A finished Breed of Horses,"[1] by W. H. Brewer. V. "A Systematic Study of the Action of Definitely Related Chemical Compounds upon Animals,"[1] by Wolcott Gibbs and Hobart Emory Hare. VI. "The Cretaceous Flora of North America," by J. S. Newberry. VII. "On the Zoological Relations of some Palæozoic Fishes," by J. S. Newberry. VIII. "The Evolution of the Mammalian Molar Teeth to and from the Tritubercular Type,"[2] by Henry F. Osborn; presented by E. D. Cope. IX. "Some Scientific Results of the Albatross Expedition from Washington to San Francisco,"[2] by L. A. Lee; presented

[1] Read November 13th.
[2] Read November 14th. The remainder read November 15th.

by A. E. Verrill. X. "Some Measurements of Relative Wavelengths," by A. A. Michelson and E. W. Morley. XI. "A New Mineral from Maine," by E. S. Dana. XII. "Remarks on the Expression of the Law of Attraction in the Stellar Systems," by C. H. F. Peters. XIII. "Notes on the Satellite of Neptune," by A. Hall. XIV. "The Problem of Soaring Birds," by G. K. Gilbert. XV. "The Laws of Corrasion," by J. W. Powell.

THE WESTERN SOCIETY OF NATURALISTS held its first annual meeting October 24th and 25th, 1888, in the Physical Lecture-room of the Illinois State University, Champaign, Ill. Twenty-six members, representing six States, were in attendance. The meeting was called to order by the President, Dr. S. A. Forbes, and welcomed to the State and to Champaign by Prof. T. J. Burrill, Vice-President of the University. The first paper, on the "Teaching of Botany," was by Dr. D. H. Campbell, of Indiana University. He advocated the logical method of beginning with the simple and leading up to the complex, even with pupils as young as those in the high-schools, and the constant use of the compound microscope. The discussion which followed showed considerable diversity of opinion as to method, but all were agreed in relegating the analysis of flowers to the background. The other paper of the afternoon was by Prof. W. J. Beal, of the Michigan Agricultural College, who gave an account of a museum of plant products.

In the evening, Dr. S. A. Forbes, of the Illinois State University, gave the presidential address, detailing the character, scope, and objects of the Society, and then Pres. T. C. Chamberlain, of the Wisconsin State University, detailed the methods of investigation in quaternary geology.

Thursday morning the following papers were read: "Collegiate Instruction in Physiology," by Prof. O. P. Jenkins, of DePauw University; "Collegiate Instruction in Geology," by Prof. Samuel Calvin, of Iowa University; and "Biology in the High School," by Prof. W. H. Hatch, of Rock Island. Prof. J. T. Burrill exhibited a convenient and compact apparatus for taking photographs of microscopic objects, and explained its use. Prof. O. P. Jenkins exhibited a simple microtome invented by Prof. J. P. Naylor, which would cut ribbons of sections, the thinness of which is only limited by the pitch of the screw and the edge of the razor, while the instrument could be manufactured at a profit for ten or fifteen dollars. The following officers were elected for the ensuing year: President, Dr. T. C. Chamberlain, of Madison, Wis.; Vice-Presidents, Prof. J. T. Burrill, of Champaign, Ill., Pres. D. S. Jordan, of Bloomington, Ind., Prof. Samuel Calvin, of Iowa City, Iowa; Secretary, Prof. J. S. Kingsley, of Bloomington, Ind.; Treasurer, Prof. John M. Coulter, of Crawfordsville, Ind. It was

voted to hold the next annual meeting in Madison, Wis., in October, 1889, the exact date to be set by the Executive Committee.

Friday afternoon, after the transaction of some business, Dr. S. A. Forbes and Prof. H. Garman presented an account of the methods of investigating the contagious diseases of insects. Dr. C. O. Whitman, after giving several hints in matters of microscopical and embryological technique, outlined his plans for an inland biological laboratory, for which he asked the co-operation and active support of the colleges and universities of the Northwest. Prof. W. A. Locy, of Lake Forest University, read a paper on the "Teaching of Zoology in Colleges." Prof. Josua Lindahl exhibited a simple instrument he had devised for obtaining the contours and outline sections of skulls and other objects. After passing the usual resolutions and also one expressing their interest and intention to aid in the establishment of the laboratory advocated by Dr. Whitman, the Society adjourned.

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. —*Report of the committee to secure from Congress the abolition of the duties on scientific books and apparatus imported into this country.* —The committee made the following report:—

Shortly after its appointment Dr. J. S. Billings resigned, suggesting that a member from the West be selected to fill his place. Prof. Langley, president of the Association, therefore appointed Prof. A. H. Worthen, of Springfield, Ill., to the vacancy. Upon the death of Prof. Worthen, which followed not long after, Prof. S. A. Forbes of Champaign, Ill., was selected by Prof. Langley to fill his place.

The eastern members of the committee, Paof. J. R. Eastman and Prof. E. D. Cope, chairman, have held several meetings with the following results. The following resolution was adopted and signed by all the members:—

Resolved: That there shall be admitted to this country, free of duty, all books in languages other than English; of books in the English language all single copies sent to periodicals issued not oftener than once a week; all books issued by governments and scientific societies, and all other books not republished within a year after the first publication in an English-speaking country.

Also all apparatus, instruments and material to be used in scientific experiment or original research; decision as to the intention of the importer to rest with a committee of the U. S. National Academy of Sciences.

This resolution was placed in the hands of the Committee of Ways and Means of the House of Representatives of which the Hon. R. Q. Mills is chairman, through Hon. W. C. P. Breckinridge of Kentucky, one of its members. The resolutions were received with consideration and had the attention of the committee while engaged in framing what is known as the Mills Tariff Bill. The

recommendations contained in the resolutions were partially incorporated into the bill in the following language (H. R. 9051, p. 1 and 7).

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, that on and after the first day of July, 1888, the following articles mentioned in this section, when imported, shall be exempt from duty:

"Bibles, books and pamphlets printed in other languages than English, and books and pamphlets and all publications of Foreign Governments, and publications of Foreign Societies, historical or scientific, printed for gratuitous distribution."

This provision, although not covering the case of scientific publications produced in England, is a great advance over previous legislation on the subject.

As it is probable that the Mills bill in its present shape will not pass the Senate, and as the Senate is preparing a tariff bill as a substitute for it, the resolutions of your committee have been submitted to the committee of the Senate engaged in preparing this bill, of which Senator W. B. Allison is chairman. There is every reason to believe that the suggestions therein contained will receive the respectful consideration of that committee.

It has been hoped that some relief from the tax on knowledge at present imposed by the government of the United States might be largely relieved by the operation of the bill which has passed both houses of Congress, known as the Chace copyright bill. Such relief would really result, in the case of scientific books of which the sale should be sufficiently large to justify their republication in this country by foreign publishers, since they would then cease to be imported; but, unfortunately, the books most needed by students engaged in original research in this country are generally of a kind that are not republished, owing to the limited demand for them relatively to other kinds of literature.

By resolution of the American Society of Naturalists, your committee has been made the recipient of the following preambles and resolutions, and its request for the presentation of the same to Congress:—

"Whereas, the cause of education in science is retarded by the restrictions placed by Congress on the importation of scientific books and apparatus: whereas we believe that advance in the arts and industries depends on the development of science and is impeded by the before-mentioned import duties, and that all restrictions on education and scientific research are unworthy of enlightened government: whereas the scientific books published abroad are absolutely essential to students and investigators, and are but rarely duplicated in this country: whereas the value of scientific apparatus is in nearly all cases dependent on the individuality of the maker: and whereas colleges and incorporated institutions are now permitted to import apparatus duty free, while private investigators, usually less able to afford expense, are obliged to pay duty, therefore

"*Be it resolved*, That ———— hereby requests the Representatives of the state of ———— in the Congress of the United States to use all pos-

sible efforts to have placed on the free list, books pertaining to the physical, natural and medical sciences, and apparatus intended for purposes of scientific research or of education : and further be it

"*Resolved*, That a copy of these preambles and resolutions be forwarded to each member of Congress."

These resolutions were sent, by resolution of the same society, to the faculties of the universities and colleges throughout the United States for their approval and signature. Replies expressing this approval and signed by the faculties, or their accredited officers, were received from the following institutions :—

The American Philosophical Society, Philadelphia; The Franklin Institute, Philadelphia ; the Academy of Natural Sciences, Philadelphia; the County Medical Society, Philadelphia; the Society of Arts, Boston ; Brown University, Providence, R. I. ; Bryn Mawr College, Pa. ; Wellesley College, Mass. ; Iowa College, Iowa ; Michigan University, Ann Arbor, Mich. ; Wesleyan University, Middletown, Conn. ; Naval Academy, Annapolis, Md. ; Middlebury College, Vt. ; Hamilton College, Clinton, N. Y. ; Swarthmore College, Pa. ; Adelbert College, Ohio ; Williams College, Williamstown, Mass. ; College of the City of New York ; University of Alabama, Tuscaloosa, Ala. ; Lafayette College, Easton, Pa. ; Amherst Agricultural College, Amherst, Mass. ; Haverford College, Pa. ; Smith College, Mass. ; Columbian University, Washington, D. C. ; Stevens Institute of Technology, Hoboken, N. J. ; University of Indiana, Indiana ; Lehigh University, Bethlehem, Pa. ; University of California, Berkeley, Cal. ; Hobart College, New York ; College of Physicians and Surgeons, New York City ; University of North Carolina, N. C. ; Columbia College School of Mines, New York City ; Union College, New York ; Kenyon College, Ohio ; Northwestern University, Evanston, Ill. ; Marietta College, Ohio ; University of Virginia, Charlottesville, Va. ; Cornell University, Ithaca, N. Y. ; Hampden Sidney College, Va.

As regards the removal of duty from imported philosophical and scientific apparatus, your committee cannot report much progress. Our efforts have been mainly directed to the removal of the duty on books, under the belief that success in this direction will prepare the way for further advance. We have not, however, neglected this important subject. The Mills tariff bill thus refers to it (pp. 27 and 32):

(p. 32.) "And on and after October first, 1888, in lieu of the duties heretofore imposed on the articles hereinafter mentioned in this section, there shall be levied, collected and paid the following rates of duty on said articles severally."

" Philosophical apparatus and instruments, twenty-five per centum ad valorem.

Your committee hope to be able to secure the total abolition of the duties on foreign books of science, and the great reduction, if not abolition, of those on apparatus. We base this hope on the activity in the direction of change in the existing laws on this subject, at present existing in Congress, and the evident desire of the representatives of both the great political parties of the country to legislate for the best interests of their constituents, as they understand them. At the moment of preparing this report it is not

possible to announce any final result of the action of your committee, but it is quite possible that improved legislation may be attained by the time of the meeting of the Association to which this report is made.

In conclusion we find that what is needed to effect the result desired, is a continuation of the effort, already commenced, of vigorous protest against the laws on the subject as at present existing; laws which obstruct knowledge at its fountain-head; which impose onerous burdens on a class which works gratuitously for the public good, and which place our country in a false position among the enlightened nations of the earth.

EDW. D. COPE, Philadelphia, *Chairman.*
J. R. EASTMAN, U. S. Naval Observatory, Washington, D. C.
S. A. FORBES, Champaign, Ill.

SCIENTIFIC NEWS.

—Dr. Paul Langerhans, formerly professor in Freiburg i. B., died in Funchal, Madeira, July 20th, 1888, aged forty-one years.

—A heavy earthquake shock was felt in the city of Mexico, September 6th, 1888. In its violence it exceeded any hitherto recorded there.

—Prof. Graf zu Solms-Laubach, of Tübingen, succeeds to Prof. de Bary's place as editor of the *Botanische Zeitung*, while Dr. Kohl, of Marburg, has accepted the position of editor of the *Botanische Centralblatt.*

—The Indiana Academy of Science will hold its fourth annual meeting at Indianapolis, December 25th to 27th. The address of the retiring President, Dr. J. P. D. John, will be given on the evening of the 25th. As last year the programme was crowded, it has been decided to organize four sections this year: A, Zoology; B, Botany; C, Chemistry, Physics, and Mathematics; D, Geology and Geography.

—The British Association at its Bath meeting made the following grants for Geology, Biology, Geography and Anthropology: Geological Record, £80; Erratic Blocks, £10; Volcanic Phenomena of Japan, £25; Volcanic Phenomena of Vesuvius, £20; Fossil Phyllopoda of the Palæozoic Rocks, £20; Eocene Beds of the Isle of Wight, £15; Fossil Secondary and Tertiary Plants of the United Kingdom, £15; Zoology and Botany of the West

Indies, £100; Marine Biological Association, £200; Flora of China, £25; Physiology of the Lymphatic System, £25; Deep-sea Tow-net, £10; Natural History of the Friendly Islands, £100; Geography and Geology of the Atlas Range £100; Effect of Occupation on Physical Development, £20; Northwestern Tribes of Canada, £150; New Edition of Anthropological Notes and Queries, £50; Calculating the Anthropological Measurements taken at Bath, £5; Exploration of Roman Baths at Bath, £100; Characteristics of Nomad Tribes of Asia Minor, £30. Apparently no grant was made this year for the Zoological Record, a work which may well be allowed to lapse, since its place is so much better filled by the Naples "Jahresbericht."

—Rewards for Meritorious Discoveries and Inventions. —The Committee on Science and the Arts of the Franklin Institute, of the State of Pennsylvania, is empowered to award, or to recommend the award of, certain medals for meritorious discoveries and inventions, which tend to the progress of the arts and manufactures.

These medals are:—

1.—*The Elliott Cresson Medal* (*gold*), to be awarded either for some discovery in the arts and sciences, or for the invention or improvement of some useful machine, or for some new process, or combination of materials in manufactures, or for ingenuity, skill, or perfection in workmanship.

2.—*The John Scott Legacy Premium and Medal* (*twenty dollars and a medal of copper*) was founded in 1816, by John Scott, a merchant of Edinburgh, Scotland, who bequeathed to the City of Philadelphia a considerable sum of money, the interest of which should be devoted to rewarding ingenious men and women who make useful inventions. The premium is not to exceed twenty dollars, and the medal is to be of copper, and inscribed "*To the most deserving.*"

—The following is taken from the New York *Herald:* The Peabody Museum of American Archæology and Ethnology, of Cambridge, Mass., through the liberality of Mr. Charles P. Bowditch, of Boston, and other gentlemen interested in the subject, is about to send an expedition to explore the ruins of Yucatan, the command of which has been offered to Consul Edward H. Thompson, who has accepted. As apractical archæologist and writer upon the subjects connected therewith, Mr. Thompson is already eminent. His large experience and valuable discoveries among the lost cities in the almost unknown interior of Yucatan and Central America, make his selection for the proposed work most promising for its success. His present position as Consul to Yucatan was proffered him by our government with a view to a thorough ethnological and archæological study of the ruins in that country. The expedition will occupy several months. The draughtsman, photographer and naturalist will probably leave the United States in December.